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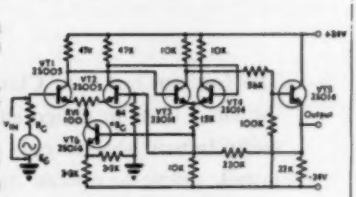

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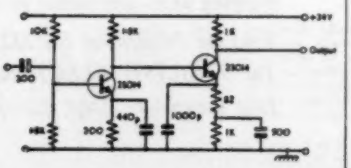

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ELECTRICAL ENGINEERING ABSTRACTS

Volume 63 **MAY 1960** **Number 749**

GENERAL

(For abstracts on circuit theory see also Lines . Networks . Filters)

621.3

2613 **BRITISH ELECTRICAL PROGRESS. SURVEY OF RECENT ACHIEVEMENTS IN PLANT AND EQUIPMENT DESIGN.**
Elect. Rev., Vol. 166, No. 5, 193-204 (Jan. 29, 1960).

621.3.011.1

2614 **THE ANALYSIS OF PERIODIC PHENOMENA WITHOUT INTEGRATION.** J.Lagasse and R.Lacoste.
Rev. gen. Elect., Vol. 68, No. 11, 629-33 (Nov., 1959). In French.

Two little known methods for the evaluation of Fourier coefficients without the use of integration are described. The Traian–Lalescu method is applicable when an analytic expression for the function to be analysed is known, and is particularly useful for discontinuous functions. The method of Fischer and Hinnen applies to the case where no analytic expression is available. G.D.Sims

621.3.013.2

2615 **THE ELECTROMAGNETIC ENERGY STORED IN A DISPERSIVE MEDIUM.** T.Hosono and T.Ohira.
Proc. Inst. Radio Engrs, Vol. 48, No. 2, 247-8 (Feb., 1960).

An expression is obtained for the energy stored in a medium whose permittivity and permeability are both dependent on frequency. This is compared with the theory due to Brillouin (1921).
V.G.Welsby

621.3.013.78

2616 **SCREENING ACTION OF FERROMAGNETIC PLATES ON THE MAGNETIC FIELD PRODUCED BY DIRECT CURRENT.** É.A.Meerovich and A.M.Arakelyan.
Elektrichestvo, 1959, No. 9, 51-7 (Sept.). In Russian.

The field distributions due to an infinitely long line current parallel to an infinitely long screen of finite width were calculated for screens of simple shapes. The distributions for the flat and cylindrical screens are considered in detail. Z.Krasucki

621.3.015.3

2617 **CORRELATION OF FORCED AND FREE OSCILLATIONS OF COILS AND WINDINGS.** P.A.Abetti.
Trans Amer. Inst. Elect. Engrs III, Vol. 78, 986-95 (1959) = Pwr Apparatus Syst., No. 45 (Dec., 1959).

It is shown that there exists a simple relationship between the forced and free oscillations of coils and windings which are generally treated in the literature as two separate phenomena. As a consequence, a correlation also exists between certain natural frequencies of a coil or winding under different terminal conditions. Experimental measurements on air coils, iron-core coils, and transformer windings prove the correctness of the theory. The frequencies are determined analytically by energy methods.

621.3.018.6 : 534.1

2618 **VIBRATION STUDIES IN THE SOVIET UNION. A REVIEW.** Yu. I Iorish.
Akust. Zh., Vol. 5, No. 3, 263-74 (1959). In Russian.

The review deals only with the Soviet work (146 references) on harmful mechanical vibrations; it does not deal with studies of the origin or prevention at source of these vibrations. The review is divided into four chapters: (1) measurement, (2) testing, (3) insulation, (4) effect on instruments. [English translation in: Soviet Physics – Acoustics (New York), Vol. 5, No. 3, 269-81 (Feb., 1960)].
A.Tybulewicz

POWER RESOURCES PRIME MOVERS

620.9

2619 **ECONOMIC TRENDS IN THE PRODUCTION OF HYDRO-ELECTRIC ENERGY IN INDIA.** M.Hayath and K.L.Vij.
World Power Conf., Canadian Sectional Meeting, (Montreal, 1958). Section A_3. Paper 3 $A_3/5$. 14 pp.

India is very rich in water power resources, but generation is only about 2% of the country's estimated economically utilizable reserves. There are multi-purpose schemes associated with irrigation and flood control as well as schemes chiefly inaugurated for generating electricity although other benefits may result from them. Most of the future schemes will be in the latter category. The costs of the new schemes, being larger to meet the growing demands, compare very favourably, in spite of the increased costs of construction, with those of the older ones. The Jog Scheme is cited as an example. Although the hydro-electric power generated from multi-purpose schemes, which require expensive civil engineering work, costs more than the power from schemes initiated solely for that purpose, it is still economic in comparison with the alternatives. Hydro-electric schemes also have the advantage of requiring less imported equipment than either nuclear or thermal plants. The economic expansion of the country is stimulating the development of hydro-electric power and industries are moving towards its sources. A survey, which is being conducted by the Central Water and Power Commission, indicates that hydro-electric schemes will supply about 75% of the energy generated in the next two or three decades. The report contains tables giving details of completed and projected schemes and a map showing the distribution of hydro-resources.
E.W.Golding

620.9

2620 **ECONOMIC CO-OPERATION BETWEEN HYDRO, THERMAL AND NUCLEAR POWER PLANTS IN SWEDEN.** B.Aler, E.Blomqvist and S.Lalander.
World Power Conference, Canadian Sectional Meeting, Montreal (1958) Section B_3, Paper 54 $B_3/9$.

In a normal year hydro-electric-power provides about 95% of the electricity consumed in Sweden, in a wet year 98% and in a dry year 90%. The present annual output of hydro-electric-power is 27×10^9 kWh, but it is estimated that this could be increased to 80×10^9 kWh. Condensing steam-power plants, burning coal, are used during dry periods, when hydro-electric production drops, and to supply the peak loads. Back-pressure plants, burning wood-waste or waste liquor from pulp mills, are used to supply both heat and electricity and in district-heating schemes. Sweden is poor in coal, but has large uranium deposits. The first nuclear reactor, R3, constructed in Agesta, near Stockholm, for operation in 1960, will produce 75 MW of heat and 15 MW of electricity. The second, "Adam", in Vasteras, will generate 75 MW of heat only and will run in parallel with existing plant. The first project for condensing nuclear power plant, "Eva", is planned to start operation in 1963 and to generate 100 MW of electricity. It will be constructed entirely underground. The Swedish transmission system, having a very high load capacity, does not limit the size of plants: capacities of about 500 MW can possibly be attained with natural uranium. Although nuclear energy would be uneconomic at present, if the consumption continues to increase at the same rate as in the past, it will be called upon to make a considerable contribution to the total electricity supply in the 1970's because, even when the hydro-electric potential has been developed to its fullest economic extent, it will be unable to meet the demand. E.W.Golding

620.9

2621 ECONOMIC UTILIZATION OF COAL RESOURCES OF INDIA FOR POWER GENERATION.
M.Hayath and S.Swayambu.
World Power Conference, Canadian Sectional Meeting, Montreal (1958) Section B_1, Paper 73 $B_1/8$, 15 pp.

The total hydro-electric potential in India is estimated as 35×10^6 kW. A little more than 1.5×10^6 kW have been installed and schemes for 2.5×10^6 kW are under construction. 45% of the installed capacity is hydro-electric, the rest thermal, mostly coal-fired. Nuclear power is in a very preliminary stage and for the next twenty years is not likely to account for more than about 10% of the total capacity. The annual coal requirements for all purposes are about 40×10^6 tons and are expected to rise to 300×10^6 tons by 1975. The exploitation of newly-discovered coal fields will probably enable the rate of production to rise to 60×10^6 tons by the end of 1960. About 44% (18×10^6 tons) of the coal is of good quality and most of it is used by the railways and metallurgical industries. Plans are being made to increase the efficiency of power plants to burn low-grade coal, especially near the mines, and to reserve higher-grade coal for transport to more distant power stations. Most of the new schemes and extensions will combine the use of hydro-electric power and thermal power. Closer cooperation between the Coal Controller's Organization, the Fuel Research Authorities and the Central Water and Power Commission is recommended so that coordinated plans on a nation-wide basis can be put into effect. It would also be an advantage to develop as far as possible a standardized design for power stations, based on the power demand and the conditions of operation. The report contains useful tables of data on thermal power stations. E.W.Golding

620.9

2622 THE ROLE OF WATER POWER IN THE FORMATION OF LARGE POWER SYSTEMS AND CONSOLIDATED SYSTEM IN THE SOVIET UNION. L.O.Saatchjan and G.N.Lyalik.
World Power Conf., Canadian Sectional Meeting, (Montreal, 1958), Section A_2, Paper 64 $A_2/11$, 13 pp.

Hydro-electric power stations play an exceptionally important part in the creation of power systems in the U.S.S.R. and in their consolidation. For example, the Dnieper hydro-electric stations were the main factor in forming the Dnieperenergo power system and then again in the consolidation of the three systems in the South (the Donbass, Dnieper and Rostov systems). Large steam stations, connected with hydro-electric stations, will be built near the rich open-cast coal mines in Central Siberia. The two largest systems in the Soviet Union are the Consolidated European Power System and the Consolidated Central Siberian Power System. The advantages of consolidation in making the best use of hydro-electric power and saving fuel in the steam stations more than offset the cost of transmission lines, some of which are long, operating between 400 and 500 kV. Similar advantages are obtained in the smaller systems. In Eastern and Western Georgia stations on rivers from a glacial source operate in combination with stations on rivers from a rain source, the two types compensating for each other's non-uniformities. The paper includes graphs of average monthly output and of daily load curves for hydro-electric stations working both separately and jointly. E.W.Golding

620.92

2623 THE SUMMATION CURVE — ITS ESTABLISHMENT AND APPLICATION IN HYDROLOGY. J.Otnes.
Water Pwr, Vol. 12, No. 3, 112-20 (March, 1960).

It is explained how these curves can be used in computing many problems of river regulation for power and other purposes.

621.039

2624 INSTRUMENTATION FOR THE RO REACTOR. G.Jonsson.
Tekn. T., Vol. 90, No. 6, 131-6 (Feb. 5, 1960). In Swedish.

Severe demands are placed on the instrumentation in order to prevent criticality accidents. For shutting down the reactor, a safety device is arranged in the superstructure of the reactor, allowing automatic insertion of the safety rods. Measurement of the reactor output and effect is explained, schematic diagrams of the apparatus being shown. Two similar pulse counting systems cover the 10^{-9}–10^{-1} W range for the output, likewise two pulse counters are used for the 0.001-100 W range for the reactor period. The power regulation system is considered. In the RO, the reactivity is influenced by changes in the moderator level, and it is fitted with a special piston pump for fine regulation of the moderator, the pump being driven by a Ward Leonard system. In considering conditions of safety, a list of situations, under which reactor operation is prohibited, is given. G.N.J.Beck

621.165

2625 RECENT TRENDS IN THE DEVELOPMENT OF THE STAL TURBINE. C.Larsson.
Asea J., Vol. 32, No. 7-8, 91-8 (1959).

The historical background to the development of the STAL Durax turbine is briefly sketched. Methods of improving turbine efficiency, the selection of suitable turbines for nuclear power-stations, and governing systems, are also discussed.

621.224

2626 PERFORMANCE OF LARGE-WATERWHEEL-GENERATOR PIVOTED-PAD THRUST BEARING DETERMINED BY TESTS UNDER NORMAL OPERATING CONDITIONS.
R.A.Baudry, E.C.Kuhn and G.D.Cooper.
Trans Amer. Inst. Elect. Engrs III, Vol. 78, 1300-15 (1959) = Pwr Apparatus Syst., No. 45 (Dec., 1959).

A description of tests taken on site of 2 large thrust bearings installed at Coulee dam and Chief Joseph dam. For the first, the max. designed thrust load is 2 040 000 lbs., the bearing dia. is 96 inch at 120 rev/min. For the second, these figures are 1 284 000 lbs., 84 inch and 100 rev/min. After a discussion of the effect of temperature and geometry of the oil-film on the performance and the optimum support for pads, operating experience is given and test programmes are explained. Readings were taken of the temperature under all conditions, the thickness of the oil-film when starting and running, coefficient of friction, deformation. Methods of taking the measurements are fully described. A bibliography and discussion are added. R.G.Jakeman

621.224.1

2627 THE CROSS-FLOW TURBINE. L.A.Haimerl.
Water Pwr, Vol. 12, No. 1, 5-13 (Jan., 1960).

Describes a type of water turbine which is being used extensively in small power stations, especially in Germany.

POWER SUPPLY
POWER STATIONS

621.311.1

2628 FOR AN ACTIVE POWER BALANCE-SHEET. M.Štětka and M.Piha.
Energetika (Prague), Vol. 10, No. 1, 3-5, 15 (1960). In Czech.

The average ratio of night load minima to peak load during the day was 0.69 in Czechoslovakia in the year 1958 and it is claimed that Czechoslovakia was in this respect first in the world. Methods of power supply in Czechoslovakia are sketched and the basic policy of the supplier–customer relationship is discussed. While in earlier years power had to be supplied at any cost, for the future, uninterrupted high quality and economical power service is advocated. N.Klein

621.311.1

2629 ECONOMIC TRENDS IN THE PRODUCTION OF HEAVY ELECTRICAL EQUIPMENT FOR POWER SUPPLY. P.Krebs.
World Power Conf., Canadian Sectional Meeting (Montreal, 1958), Section $A_2/2$, Paper 52 $A_2/2$, 12 pp.

Plant for the generation and transformation of electricity is principally manufactured in the U.S.A., the industrial countries of Western Europe, the U.S.S.R. and Japan. The production of alternators for steam turbines is considerably greater, and for hydraulic turbines considerably less, in the United States than in Western Europe. The exports of the United States are small compared with their production. Manufacturers should give special attention to developing countries in which electricity consumption is doubling in less than the normal ten years. In 1950, 28% of the world's population consumed 88% of the electricity generated in the world, but this situation will change in the future. According to a recent report of the World Bank, $869 million, out of loans totalling $2 528 million, were spent on the production of power. Even if the rate of growth of power

consumption in the older industrial countries decreases in the next few years, their exports of plant for the generation, transformation and distribution of electricity will probably rise considerably to meet the demands of the developing countries. E.W.Golding

621.311.1

2630 ECONOMIC TRENDS IN PRODUCTION OF ELECTRICITY AND HEAT BY U.S.S.R. ELECTRIC UTILITY POWER STATIONS BURNING ORGANIC FUEL.
B.M.Sokolov-Andronov, L.M.Mittelman and Y.I.Bunkin.
World Power Conference, Canadian Sectional Meeting, Montreal (1958) Section B_4, Paper 66 $B_4/10$, 23 pp.

According to the 6th Five Year Plan, the U.S.S.R. are to increase electricity production in 1960 to 300×10^9 kWh, i.e., about 150% of the total for 1956. At the end of 1956, electric utility steam-power stations had a generating capacity of 20.1×10^6 kW (58.5% of the total capacity of steam power stations). The development of special furnaces and hydraulic ash-handling equipment has enabled about sixty different kinds of low-grade fuels, including high-ash content coal, coal enrichment wastes, bituminous shale, peat and lignite, to be used economically. 45% of the total extraction of peat is consumed in electric-utility power stations. District heating is one of the principal means of improving the efficiency of steam power stations. The heat is supplied in the form of steam or hot water, most of the steam being used for industrial processing. In the next few years, extensive use is to be made of power stations operating at high steam pressures and temperatures and district heating schemes are to be further developed. The report contains diagrams and tables of installed capacity, energy production and fuel consumption. E.W.Golding

621.311.15

2631 PRODUCTION AND USE OF ELECTRICAL ENERGY IN SWITZERLAND DURING THE HYDROGRAPHIC YEAR 1958/59.
Bull. Assoc. Suisse Elect., Vol. 51, No. 6, 259-77 (March 26, 1960). In French.

621.311.16

2632 GRAPHS OF SUPER-IMPOSED ELECTRICAL LOADS OF A POWER SYSTEM. Ya.D.Barkan and A.D.Kozlov.
Elekt. Stantsii 1958, No. 8, 56-8 (Aug.). In Russian.

Discusses the future configuration of a power system as indicated in graphs representing the average weekly power loads in short-term (1-3 years) load forecasting, the dynamics of load fluctuations for individual months, daily load throughout the year, and the periods for characteristic points in a load curve over the various months. The use of statistical data for short-term load forecasting is possible only under normal supply conditions. Where there is systematic power shortage the information gives a false impression of demand growth.
Central Electricity Generating Board Digest

621.311.16

2633 A STUDY OF THE ECONOMIC SHUTDOWN OF GENERATING UNITS IN DAILY DISPATCH.
C.J.Baldwin, K.M.Dale and R.F.Dittrich.
Trans Amer. Inst. Elect. Engrs III, Vol. 78, 1272-84 (1959) = Pwr Apparatus Syst., No. 45 (Dec., 1959).

Presents a comprehensive study of the economic shutdown of generating units in daily service on one generating system in the U.S.A. It formulates rules for the system operator to follow in selecting units to be run, and it evaluates penalties imposed by departures from the optimum rules. The study includes determination of the most economic combination of available generators to meet the load throughout the year, and the extra cost involved for different values of the "spinning" reserve. Considerable data for the system of 22 generating units on which the study is based are given together with a bibliography and discussion. J.T.Hayden

621.311.161

2634 FLUCTUATIONS IN THE POWER TRANSMITTED OVER AN INTERCONNECTION. D.Gaden.
Bull. Assoc. Suisse Elect., Vol. 50, No. 25, 1217-25 (Dec. 5, 1959). In French.

Discusses problems of the international grid as seen by a small system. The results of tests on interconnection with a larger system are reproduced, comparing the direct and indirect methods of control. A suitable value of the regulator response-speed is indicated. P.Linton

621.311.161 : 621.316.726

2635 ECONOMICS OF CENTRALIZED CONTROL OF ELECTRIC GENERATING PLANTS.
T.D.Stanley and G.F.Green.
World Power Conference, Canadian Sectional Meeting (Montreal, 1958), Section A_1, Paper 41 $A_1/12$, 19 pp.

The fact that, in Canada, the average price per kWh of electricity sold for residental purposes was 10.5% lower in 1953 than in 1939, although during the same period the Consumer Price Index rose 82.7%, indicated the increasing efficiency of the electricity supply industry. Automation is particularly effective in an industry operating 24 hours a day because the advantage of increased production per man-hour can be obtained for 8760 hr per year, compared with about 2080 hr per year with normal daytime working. Centralized control, by which a number of power stations can be controlled from a central dispatching point which may be several miles away, was first used in the 1920's. The conditions under which it can be economic are discussed; the saving in man-hours has to be balanced against the capital cost of the additional plant facilities required. It is estimated that a capital expenditure of about $185 600 can be justified to save the employment of one operator. Centralized control can be more easily effected in a hydro-electric system. In a conventional thermal plant, it is applicable only to that part of the station associated with the electrical operation. Automatic, remote and supervisory control has been adopted almost completely in the Calgary Power Hydro system and in the British Columbia Electric Company system. A gas-turbine generating station, using natural gas and having four 25 MW units, has also been constructed for remote control from Vancouver. This is thought to be the first gas-turbine generating station to be automatically operated. The report contains three maps outlining the electrical systems and some interesting tables of costs. E.W.Golding

621.311.176

2636 POWER PLANT CONTROL BOARD LOCATIONS AND OPERATION. E.G.Norell.
Trans Amer. Inst. Elect. Engrs III, Vol. 78, 1381-8 (1959) = Pwr Apparatus Syst., No. 45 (Dec., 1959).

Discussed recent trends in the control of thermal power stations aimed at reducing the number of operators. Local start-up boards with a central control for running are suggested; it may be economical to have one man with data-logging equipment on an 8-unit station. For smaller plants roving operators with an annunciator alarm are preferable. P.Linton

621.311.2

2637 THE ECONOMICS OF BY-PRODUCT POWER GENERATION. W.P.London and W.M.Newby.
Engng J., Vol. 42, No. 12, 63-8 (Dec., 1959).

Several processes have been used for the production of by-product power. The most common of these employs steam turbines of the back-pressure or extraction type. This type of equipment has wide application and is considered in some detail. An attempt is made to show what factors effect the overall economy of such a cycle and what circumstances are likely to favour this type of installation. The effects of initial steam conditions, fuel costs, equipment costs, and load characteristics, both electrical and steam, are considered. These factors are illustrated by a typical example. The application of by-product power generation to various industries is discussed, and descriptions of plants for the pulp and paper and chemical industries are given. Although less widely applicable than steam turbines, gas turbines can also be used in a by-product power cycle. This is briefly discussed. Other refinements and alternative cycles are mentioned.

621.311.2

2638 RESPONSE OF STEAM AND HYDROELECTRIC GENERATING PLANTS TO GENERATION CONTROL TESTS. A.Klopfenstein.
Trans Amer. Inst. Elect. Engrs III, Vol. 78, 1371-87 (1959) = Pwr Apparatus Syst., No. 45 (Dec., 1969).

Presents some of the control characteristics of generating plants as determined by field measurement. Tests on generating units in service have determined that governor dead-band varies widely between governors and between load points for some governors. Large new steam turbines have been found with governors having dead bands so large that the governor seldom caused the unit to help correct system frequency. The backlash in governor control linkages on some units was found to cause long time lags in control when initiated by automatic dispatching systems. Time delays in combustion control action and boiler thermal time lags

were measured. These caused generation to continue to change for periods of time following a change in turbine control valve position. Frequency-response tests of generation controls of an overall generating plant were conducted. Time delays in generation change measured after step changes in controls help explain the phase and magnitude changes measured during frequency-response tests. It is shown that control characteristics can be measured with manually controlled generating plants. Some of the data obtained may be useful in designing improved controls for future computer-operated plants.

621.311.2

2639 DESIGN FEATURES OF BULK POWER STATIONS ON THE SOUTHERN CALIFORNIA EDISON COMPANY SYSTEM. O.R.Bulkley.
Trans Amer. Inst. Elect. Engrs III, Vol. 78, 1405-16 (1959) = Pwr Apparatus Syst., No. 45 (Dec., 1959).

Describes the design features of present day 220-66 kV bulk power stations and points out economics and advantages which have been obtained by improved methods of station construction, strain-bus, switchrack, circuit-breaker, transformer and protective equipment design. The transmission system included 20 bulk-power stations. G.V.Hargreaves

621.311.21

2640 CACHOEIRA DO FRANÇA HYDRO-ELECTRIC STATION ON THE RIO JUQUIA IN BRAZIL. M.Ebersberger.
Brown Boveri Rev., Vol. 46, No. 5, 288-98 (May, 1959).

621.311.21

2641 PLANNING AND CONSTRUCTION OF THE CHUTE-DES-PASSES HYDROELECTRIC POWER PROJECT.
F.T.Matthias, F.J.Travers and J.W.L.Duncan.
Engng J., Vol. 43, No. 1, 39-51 (Jan., 1960).

This scheme utilizes the power potential below the existing Lake Peribouka storage reservoir, Quebec. A double intake permitting level variations of 105 ft leads to the 31 000 ft long supply tunnel of 35 ft dia., followed by a 130 ft dia. surge tank with overflow reservoir; 5 steel-lined penstocks 15/11 ft dia. and 256 to 394 ft long run to the underground power station. Five Francis turbines operate under 590-470 ft head driving 190 MVA 14.4 kV alternators. Aluminium busbars rise 480 ft to the surface substation with 65 MVA 1-ph transformers and 380 kV 1500 MVA switchgear. Two single-circuit lines 91 miles long are provided. P.Linton

621.311.21

2642 THE ROSELEND HYDROELECTRIC DEVELOPMENT. THE LA BATHIE POWER HOUSE PENSTOCK.
R.Cartier.
Houille blanche, Vol. 15, No. 1, 4-21 (Jan.-Feb., 1960). In French.

621.311.21

2643 REVERSIBLE PUMP–TURBINES AT NIAGARA FALLS.
F.E.Jaski and W.W.Weltmer.
Mech. Engng, Vol. 82, No. 3, 74-7 (March, 1960).

Tuscarora, the pumped storage plant on the American side, contains 12 reversible Francis sets which are each rated 25 MVA, 75 ft head as turbines and 37 500 h.p., 85 ft head, 3400 ft^3/s as pumps. The speed in both cases is 112.5 rev/min. Extensive model tests were carried out and details of the transient machine characteristics are reported. A special wicket gate was designed to give approximately equal operating forces for both directions of flow.
P.Linton

621.311.21

2644 MACHINERY INSTALLED AT THE ROTHENBRUNNEN POWER STATION. S.E.Hopferwieser.
Schweiz. tech. Z. (S.T.Z.), Vol. 57, No. 8-9, 141-61 (Feb. 25, 1960). In German.

This is the lowest stage on the Rabiusa, Switzerland. A pressure tunnel 12 km long leads to the pressure shaft, 2.5/2.1 m dia. and 1100 m long, sloping at 65%. The three sets have twin overhung Pelton turbines with single straight nozzles; they operate under 670 m head and drive 52.5 MVA, 428.6 rev/min, 14 kV alternators. Two sets of 1-ph. transformers feed 220 and 150 kV substations containing 5000 MVA and 3500 MVA air-blast switchgear suitable for rapid reclosure. P.Linton

621.311.21

2645 TRÊS MARIAS DAM [BRAZIL].
Water Pwr, Vol. 11, No. 12, 445-51 (Dec., 1959); Vol. 12, No. 1, 14-18 (Jan.); No. 2, 55-64 (Feb., 1960).

This combined reclamation and power-supply project will provide a hydro-electric station of 520 MW capacity at the toe of the dam and give an extra 400 MW firm capacity to the Paulo Alfonso station. Hydrological and civil engineering aspects are discussed and the transmission system and power station are described in detail.

621.311.21

2646 THE VIANDEN DEVELOPMENT.
Water Pwr, Vol. 12, No. 3, 88-92 (March, 1960).

A short description of a 640 MW pumped-storage project, on the north-east frontier of Luxembourg, and particularly designed for the supply of peak-load energy to the centres of heavy industry in Germany.

621.311.22

2647 LARGE STEAM POWER STATIONS: PLANNING, DESIGN AND ERECTION. VOLUME I. POWER STATIONS: CHARACTERIZATION AND DATA. [Grosse Dampfkraftwerke: Planung, Ausfuhrung und Bau. Band 1, Kraftwerksatlas]. Edited by K.Schröder.
Berlin/Göttingen/Heidelberg: Springer-Verlag (1959) 1073 pp. In German.

The first section surveys two hundred of the most modern steam power stations in the world, in construction or in operation. The second section covering 560 pages is devoted to a closer description of 98 of these stations illustrated by drawings in plan and elevation of the complete layout, the basic thermal circuit plan, the electrical equipment layout and the site plan together with a perspective view of the whole station. All the important characteristics and data for each unit are tabulated and the collation of this information appears to have been most carefully and painstakingly carried out. The editor, who is director of the power stations Dept., Siemens-Schuckerkwerke A.G. has obtained a great deal of his material from those who were directly concerned in the design and erection of the various plants. In a third part are six examples of detailed specification and design of selected stations, ranging in power from 36 MW (Citta di Roma), 100 and 150 MW (Fortuna III, Köln), to 325 MW (Eddystone, U.S.A.). This portion of the book occupies 422 pages and is profusely illustrated with photographs of turbosets, condenser pumps, blowers and control equipment, sectional drawings of prime-movers and boilers, together with diagrams of steam- and water-feeds, electrical-control layout, and cooling systems. The author has concentrated on stations employing the unit construction and operation principle as being the most important and significant development today. Switchgear transformer stations and high-tension networks are not included in this work. The material is concisely and clearly presented and is highly informative. It should be of great value to design and construction engineers alike.

621.311.22

2648 EFFECT OF BOILER UNIT CURVES ON BEST DISTRIBUTION OF ACTIVE LOADS AMONGST THERMAL POWER STATIONS. A.N.Zlatpol'skii.
Elekt. Stantsii, 1958, No. 8, 6-8 (Aug.). In Russian.

Examination of the characteristics of 3 power stations burning different types of fuel shows that the relative increment in fuel consumption in a boiler expands as the load rises from minimum to nominal, the value of the expansion depending largely on the type of fuel used. The relative increment curves of the boiler can be plotted from scales for useful heat output and heat losses in boiler as well as from these increments. When the active load is distributed amongst power stations by the relative increments method the minimum fuel consumption in the system occurs when plotting of the relative increment curves of a station allows for those of the boilers. Distribution of electric loads amongst stations without allowing for boiler characteristics may loead to fuel consumption excess up to 1%. Central Electricity Generating Board Digest

621.311.22

2649 SOME CONCLUSIONS FROM DAMAGE STATISTICS ON HIGH-PRESSURE BOILERS. E.G.Gershtein.
Elect. Stantsii, 1958, No. 8, 8-11 (Aug.). In Russian.

Statistics presented include a numerical comparison of the various causes of boiler stoppage, schedules classifying high-pressure

natural-circulation boilers according to fuels used, and heating-surface damage due to faults in manufacture or assembly in the case of various types of boiler. Damage of this nature was found to be less in boilers equipped with rod mills than in others. In once-through boilers such damage was usually traceable to defects in tube welding. Central Electricity Generating Board Digest

621.311.25

2650 GAS TURBINE PLANT HAS 100-MW CAPACITY. T.Ingledow.

Elect. Wld, Vol. 153, No. 5, 36-9, 75 (Feb. 1, 1960).

The world's largest gas-turbine generating plant, fully automatic and unattended, is operating in British Columbia. Integration of a gas-turbine plant into a hydroelectric system leads to economic gains to the system as a whole. The main functions of the plant are: (a) to supplement capacity of the hydro-electric system at low water, (b) to meet unexpected high demand; and (c) to serve as an emergency source for essential services. For these applications a gas-turbine plant has advantages over a conventional steam plant namely; (a) requires only 20 minutes from cold start to full load; (b) lends itself to automatic and remote control; and (c) requires minimum auxiliary equipment and less cooling water. Capital, operating and maintainance costs are also lower. The plant consists of four two-stage twin-shaft, reheat, intercooled, open-cycle 25000 kW units. Details of plant construction, air and water supply and automatic control are briefly described. W.J.Grek

621.311.25

2651 CONSTRUCTION OF A GEOTHERMAL POWER STATION. C.F.Martindale.

New Zealand Engng, Vol. 14, No. 10, 337-46 (Oct. 15, 1959).

Describes some civil and mechanical engineering aspects of the Wairakei station.

621.311.25

2652 TRENDS IN THE DESIGN OF LARGE BRITISH NUCLEAR POWER STATIONS. H.West and A.L.Shaw.

World Power Conference, Canadian Sectional Meeting (Montreal, 1958) Section B_3, Paper 88 $B_3/6$, 20 pp.

The British Nuclear Power Programme, as indicated in the Government White Paper of 1955, envisages reactor stations being built in four successive stages of development. Berkeley, Bradwell and Hunterston are Mark I stations; Hinkley Point can be regarded as a later Mark I or an early Mark II. An approximate average specific capital cost of £145/kW is quoted for Berkeley and Bradwell, although it may be necessary to add at least £10/kW to cover such items as land purchase, high-voltage substations and access roads, not normally included in the capital cost of generators. Costs for similar stations on different sites may vary by as much as £1×10^6 according to the amount of excavation necessary and to the use of cooling towers or extensive sea or river works. In the coal-fired station, the principal aim is to improve the thermodynamic efficiency, whereas in the nuclear power station, it is to reduce the specific capital cost. According to the tables given in the report, Mark I nuclear stations will compete with the best coal-fired plant and Mark II will be even more economically attractive if the overall capital cost can be reduced to £125/kW. Nuclear power stations can now be built in Britain for export and the possibilities of their economic use in overseas countries under the special conditions that may prevail there (availability of mineral deposits, high cost of transport of conventional fuel or absence of hydro-electric power) are worth serious consideration. E.W.Golding

621.311.28

2653 MOBILE GENERATOR SETS WITH VOLTAGE STABILIZATION. V.Bunea.

Electrotechnica, Vol. 7, No. 7, 240-8 (July, 1959). In Rumanian.

621.311.4

2654 MODULAR DESIGN FOR ALUMINUM SUBSTATION STRUCTURES. G.W.Swanson and P.A.McCleer.

Trans Amer. Inst. Elect. Engrs III, Vol. 78, 1213-19 (1959) = Pwr Apparatus Syst., No. 45 (Dec., 1959).

A power company has designed and constructed substations with aluminium structures at a cost comparable with that of steel. Elaborate tests were carried out, stimulated by changes in the price of aluminium, to check the suitability of special sections. An inert-gas-shielded consumable-electrode arc welding process was used. The allowable working stress for stresses due to line loads and wind forces was extended by 33⅓%. The use of extruded bulb sections had the effect of reducing the heat-affected zone so that only a small percentage of the chord angle cross-section was affected by the weld. Weight reductions of up to 35% were achieved. J.Smuts

621.311.4 : 621.316.99

CORRELATION OF MEASURED AND CALCULATED SUBSTATION GROUND GRID RESISTANCE. See Abstr. 2086

621.311.61 : 621.397.61

D.C./SINE-WAVE PORTABLE POWER SUPPLY USING SOLID-STATE TECHNIQUES. See Abstr. 2554

ELECTRIC MACHINES

621.313.1

2655 OSCILLATIONS IN STATORS OF LARGE ELECTRICAL MACHINES. E.Lübcke.

Acustica, Vol. 7, No. 2, 113-16 (1957). In German.

The natural frequencies of the stators of large electric machines are calculated for equivalent rings, inserting the total moment of inertia of the ring cross-section (not only that of the active iron). To excite these it is not only necessary for the forcing frequency to be in resonance but there must be a certain spatial distribution of the acting forces corresponding to the required amplitude distribution in space. Otherwise, resonance does not occur. Treating the stator as a rigidly held pair of circular segments gives good agreement with measured values.

621.313.1

2656 AMPLITUDE BUILD-UP DURING ACCELERATION OF OSCILLATORY SYSTEMS POSSESSING SEVERAL DEGREES OF FREEDOM. O.I.Elgerd.

Trans Amer. Inst. Elect. Engrs III, Vol. 78, 1248-51 (1959) = Pwr Apparatus Syst., No. 45 (Dec., 1959).

Rotational systems consisting of impellers, motors and couplings possess a number of natural frequencies and are, if the damping is small, very sensitive to harmonic torque components of even small magnitudes, should the frequencies of these components coincide with any of the natural frequencies. Certain types of electric motors will deliver harmonic torque components having frequencies that vary with the motor speed. During acceleration periods these torques will excite the oscillatory system, usually on several of its natural frequencies, and amplitude build-up with accompanying dangerous stresses may occure. This general problem is analysed and an approximate semigraphical solution of the relevant differential equation is proposed.

621.313.1

2657 DISTORTION OF THE CHARACTERISTICS OF ELECTRICAL MACHINES WITH A WIDE RANGE OF SPEEDS. I.Z.Ageev.

Elektrichestvo, 1959, No. 11, 52-6(Nov.). In Russian.

Some of the factors causing distortion of the characteristics of electrical machines are examined. These include transverse armature reaction, longitudinal armature reaction, magnetizing force of the commutating sections, and asymmetry of the field of the commutating poles. The effects of these factors on the characteristics and performance are fully analysed for various electrical machines. Metropolitan-Vickers

621.313.1

2658 ANALYSIS OF SPARKING IN COMMUTATOR MACHINES. M.F.Karasev and V.P.Suvorov.

Elektrichestvo, 1959, No. 12, 50-4 (Dec.). In Russian.

Various methods suggested recently for investigating sparking in a.c. and d.c. machines are analysed, and their deficiencies shown. A new method is suggested which not only shows the distribution of sparking over the commutator but also makes is possible to find the reason for sparking in each segment. A description is given of the instruments used in this method, and some characteristic oscillograms are analysed. These show the precise reason for sparking, e.g. under- or over-compensation, and the intensity of the occurring arcs. Associated Electrical Industries (Manchester)

621.313.1

2659 ON THE QUESTION OF LOSS-VALUATION AND THE COMPARISON OF COMPETITIVE OFFERS FOR ELECTRIC MACHINES. K.Edwin and A.Hofstätter.

Österr. Z. ElektWirtsch. (Ö.Z.E.), Vol. 13, No. 2, 37-43 (Feb., 1960). In German.

The selection of the most economical machine from a number of competitive offers depends on such factors as working life, interest rate, load characteristic, and electricity charges. These are examined with the help of curves and tables. Equations are developed for the calculation of machine losses with varying load and of the average annual cost using constants that are applicable to present-day Austrian conditions and to machines of the Austrian supply undertaking. Penalty and bonus clauses are briefly discussed. It is concluded that these are only advantageous to the purchaser in special circumstances. H.Sterling

621.313.1

2660 THE INFLUENCE OF MECHANICAL AND HEAT TREATMENT ON LOSSES IN CORES OF THE FRACTIONAL-HORSEPOWER MACHINES. J.Pustola.
Przeglad elektrotech., Vol. 34, No. 10, 541-9 (Oct., 1958). In Polish.

The effect of mechanical treatment and its influence on crystalline structure and hence on magnetic properties of laminations, eddy currents, hysteresis and permittivity are discussed. The evaluation of increase of losses is derived on the basis of tests and measurements. An example of design and conclusions concerning : (a) annealing of laminations after cutting; and (b) lamination insulation,are given. M.W.Makowski

621.313.1

2661 OPERATIONAL EQUATIONS OF SOME ROTATING ELECTRIC MACHINES. F.Manea.
Stud. Cercetari Energetica, Vol. 7, No. 4, 663-93 (1957). In Roumanian.

621.313.12 : 621.315.616

2662 HIGH QUALITY INSULATIONS FOR LARGE GENERATORS. K.Abegg, C.Caflisch and F.Knapp.
Bull. Oerlikon, No. 332, 8-21 (Feb., 1960).

A review of the causes of failure of stator insulation shows that the characteristic of maximum importance is the thermomechanical strength. Winding insulation methods employed to date are said to lack sufficient thermo-mechanical strength and this has led to the introduction of a new insulating material, "Samicafolium Ao", which is synthetic resin-bonded Samicafolium with an epoxy base (Orlitsa). The tests leading up to the choice of the component parts are described and the result is a homogenous insulating material which is superior to the best hard paper materials and, in service, is also superior to any other insulation in thermo-mechanical and dielectric respects. Certain properties of the new insulation are enumerated and a note included on the bonding of Roebel conductors. R.Hawley

621.313.2

2663 CURRENTS AND LOSSES IN COMMUTATOR RISERS OF D.C. MACHINES. D.Mayer.
Elektrotech. Obzor, Vol. 49, No. 1, 24-7 (1960). In Czech.

Derives relations for the time dependence of current in commutator risers for various types of windings. The time-dependence follows a trapezoid curve. The effective value of this current and Joule losses in the risers are calculated. A numerical example is given. N.Klein

621.313.2-9

2664 THE TRANSFER FUNCTION OF A.D.C. MOTOR CONTROLLED BY CHANGING THE EXCITING VOLTAGE. E.L.Urman.
Avtomat. i Telemekh, Vol. 19, No. 6, 609-13 (1958). In Russian.
English summary: PB 141096T-5, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

The transfer function of motor with an additional series excitation winding is deduced.

621.313.223

2665 CONSIDERATIONS ON INCREASING THE POWER OF DIRECT CURRENT MACHINES.
V.Corlăteanu and G.Şerban.
Electrotechnica, Vol. 7, No. 6, 214-21 (June, 1959). In Rumanian.

Methods used for increasing the power of d.c. machines are presented: rewinding the armature or the stator, and increasing the speed of rotation. Behaviour of the modified machine is analysed and means of overcoming difficulties arising out of conversion are suggested.

621.313.3

2666 EQUIVALENT CIRCUIT FOR A MULTIPHASE SYMMETRICAL MACHINE.
I.M.Postnikov and G.M.Kirichek.
Elektrichestvo, 1959, No. 11, 44-8 (Nov.). In Russian.

The existing equivalent circuit for a multiphase symmetrical machine has the disadvantage that its parameters are determined without taking into account the actual nature of the fields of higher harmonics in the air gap and the body of the rotor. In addition, the parameters are determined for a winding with a whole number of slots per pole and phase. A description is given of an equivalent circuit and a method of calculating its parameters both for integral- and fractional-slot windings. This circuit is intended for a machine with a solid rotor, but can also be used for a machine with a squirrel-cage rotor. Metropolitan-Vickers

621.313.3

2667 THE OPTIMUM NUMBER OF CONDUCTORS IN THE SLOT OF AN ALTERNATING CURRENT ELECTRICAL MACHINE. T.Dordea.
Electrotehnica, Vol. 7, No. 3, 80-7 (March, 1959). In Rumanian.

A diagram is given which enables the direct reading of the number of layers of conductors superposed in the slot, through which equal currents are passing, so as to obtain the greatest possible power at the same losses in the same slot. The thickness of the insulation is taken into account. The influence of the deviation from the optimum case is also taken into consideration. Three worked examples are presented.

621.313.32

2668 EFFECT OF SALIENCY ON THE CHARACTERISTICS OF SYNCHRONOUS MACHINES. A.M.S.El-Serafi.
Bull. elect. Engng Educ., No. 23, 9-17 (Dec., 1959).

621.313.322

2669 DETERMINATION OF OVERTRANSIENT REACTANCES IN THREE-PHASE SYNCHRONOUS GENERATORS. A.Baciu.
Energetica (Bucarest), Vol. 7, No. 4, 157-66 (April, 1959). In Rumanian.

Examples are given of calculations and measurements made on three 10.5 kV generators, rated at 2.9 MW, 0.69 p.f., 3.75 MW, 0.75 p.f., and 4.5 MW, 0.7 p.f. respectively. The results are tabulated for frequencies of 50 and 42 c/s.

621.313.322

2670 THE SYNCHRONOUS MACHINE EXCITED FROM AN ALTERNATIVE VOLTAGE SOURCE IN STEADY OPERATING CONDITIONS. C.Bălă.
Electrotechnica, Vol. 7, No. 5, 159-61 (May, 1959). In Rumanian.

After writing the voltage equations for steady working conditions as a function of machine parameters, internal angle of the machine and phase displacement of the feeding voltages, the expression for the symmetric three-phase machine torque is established and the characteristic operating conditions in which this machine can operate are interpreted.

621.313.322

2671 EXPRESSION FOR THE COEFFICIENTS OF SYNCHRONIZING TORQUE AND OF ASYNCHRONOUS TORQUE. V.Nedelcu.
Electrotechnica, Vol. 7, No. 6, 221-7 (June, 1959). In Rumanian.

Starting from the general operational equation of the supplementary electromagnetic torque developed by the synchronous machine operating with minor oscillations,expressions for synchronizing and asynchronous torque and also the constant oscillation frequency are derived. Machines with salient poles, with and without damping windings on both axes, are considered.

621.313.322

2672 CONSTANT-FREQUENCY VARIABLE-SPEED FREQUENCY-MAKE-UP GENERATORS. B.V.Hoard.
Trans Amer. Inst. Elect. Engrs II, Vol. 78,'297-304 (1959) = Applic. and Industr., No. 45 (Nov., 1959).

These generators, intended for 400 c/s a.c. systems in aircraft, are wound-rotor induction machines, with integral rotating frequency-changers made of static components such as controlled rectifiers. Some disadvantages of existing constant-frequency systems in aircraft are enumerated: improved weight, volume, reliability and maintenance characteristics over existing brushless generators with mechanical constant-speed drives are predicted. After listing the

fundamental properties of frequency make-up generators, the system components are given in general outline followed by a weight comparison of different variants of a 60 kVA design. Preliminary test results on a prototype 1 kVA test generator are given. The discussion provides complementary and supporting data but the validity of many of the conjectural statements made, particularly in respect of synchronizing torques and response times, are questioned.

J.T.Hayden

621.313.322

2673 VARIABLE-SPEED CONSTANT-FREQUENCY GENERATOR SYSTEM FOR AIRCRAFT.

K.M.Chirgwin and L.J.Stratton.
Trans Amer. Inst. Elect. Engrs II, Vol. 78, 304-10 (1959) = Applic. and Industr., No. 45 (Nov. 1959).

Examines the various possibilities for variable-speed constant-frequency systems and concludes that for use in aircraft, the best scheme is one using a wound-rotor induction machine operated above and below synchronous speed with a semiconductor frequency-changer and a synchronous machine driven by the variable-speed shaft. Results and oscillograms of laboratory tests on a system using commercial-type machines are presented. The discussion contains further data and the fundamental principles of induction-machine operation with external excitation of the rotor circuits are re-iterated.

J.T.Hayden

621.313.323

2674 TORSIONAL VIBRATIONS IN SYNCHRONOUS MOTOR-GEARED-COMPRESSOR DRIVES.

P.B.Thames and T.C.Heard.
Trans Amer. Inst. Elect. Engrs III, Vol. 78, 1053-8 (1959) = Pwr Apparatus Syst., No. 45 (Dec., 1959).

The possible sources of sustained torsional excitation are enumerated. The pulsating component of accelerating torque produced by the synchronous motor during the starting period is examined in detail. Park's equations are modified to be suitable for computer study and the analogue computer results agree closely with test values.

R.G.Jakeman

621.313.326

2675 MODEL REPRESENTATION OF EXCITERS OF SYNCHRONOUS MACHINES. C.Apetrei and D.Crețu.
Stud. Cercetari Energetica, Vol. 7, No. 4, 695-707 (1957). In Roumanian.

Relationships between operating parameters, the characteristics of the materials and the physical dimensions of a machine are evaluated. These relationships enable the principal dimensions of the exciter to be determined in a speedy and simple manner. A particular example is evaluated by the method described.

621.313.33

2676 THE POLYPHASE INDUCTION MACHINE WITH SOLID IRON ROTOR. N.Kesavamurthy and P.K.Rajagopalan.
Trans Amer. Inst. Elect. Engrs III, Vol. 78, 1092-8 (1959) = Pwr Apparatus Syst., No. 45 (Dec., 1959).

The graphical construction, applicable for the determination of the current and flux distribution in an infinite half-space of iron, is extended to the 2-dimensional problem of the solid rotor machine, corrections being made for end effects. An analytical method is developed which agrees with the graphical method and with test results. Solid iron rotors with steel end-rings and rotors with copper end-rings are analysed. A short bibliography and discussion are added.

R.G.Jakeman

621.313.332

2677 INDUSTRIAL USES FOR AN AUXILIARY LOW FREQUENCY SUPPLY. G.L.Tiley and E.Oldfield.
Engng J., Vol. 14, No. 1, 58-62, 68 (Jan., 1960).

Enumerates the characteristics and limitations of low-frequency generators and describes the application of this equipment in supplying various types of industrial drive (e.g. mine-hoist and tube-mill equipment) and anodizing equipment for aluminium.

G.V.Hargreaves

621.313.333

2678 TWO-SPEED SINGLE-WINDING INDUCTION MOTOR. G.H.Rawcliffe.
Elect. Rev., Vol. 166, No. 4, 149-51 (Jan. 22, 1960).

Development of a new method of changing the speed of induction motors by pole-amplitude modulation is described. Winding methods additional to those described previously (see Abstr. 4551 of 1958) have been devised giving a considerable increase in power rating in the modulated connection.

621.313.333

2679 DYNAMIC BRAKING OF INDUCTION MOTORS. V.Duras.
Elektrotech. Obzor, Vol. 49, No. 1, T1-T6 (1960). In Czech.

Discusses basic properties of braking with d.c. excitation in the stator. Gives relations for the necessary m.m.f., for the calculation of torques and braking times. When the d.c. current equals the rated current the braking torque can be about 90% of the rated torque. For highest braking torques a resistance 100 times that of the rotor should be placed in series with the rotor. A simple method is given for the calculation of the braking torque characteristic, taking account of iron saturation. The time-constant of the d.c. excitation is determined. A calculated example follows.

N.Klein

621.313.333

2680 CONSIDERATIONS OF THE OPERATION OF A 2-PHASE SERVOMOTOR WITH CUP SHAPED ROTOR.

A.Fransua.
Electrotechnica, Vol. 7, No. 5, 161-7 (May, 1959). In Rumanian.

621.313.333

2681 SINGLE-PHASE INDUCTION MOTORS. M.Poloujadoff.
Rev. gen. Elect., Vol. 68, No. 10, 591-604 (Oct.); 641-56 (Nov.); 696-701 (Dec., 1959). In French.

In Part I, the cross-field theory is investigated. The rotor is simulated by a d.c. armature provided with 2 lines of short-circuited brushes at right angles. The theory is developed analytically and compared with the rotating-field theory. Both slipring and cage rotors are dealt with. Part II deals with motors with screening rings. A simple design method is developed for motors with constant air-gap and without saturated magnetic bridges. In Part III, the investigation is extended to cage motors with varying air-gap, with special reference to motors with screening rings and irregular air-gap. A bibliography is added.

R.G.Jakeman

621.313.36

2682 MEASUREMENT OF EFFECTIVE STATOR AND ROTOR RESISTANCES OF STATOR FED POLYPHASE COMMUTATOR MOTORS. O.E.Mainer.
Bull. elect. Engng Educ., No. 23, 21-4 (Dec., 1959).

TRANSFORMERS

621.314.2

2683 DRYING 400 kV POWER TRANSFORMERS IN THE TANKS. N.B.Leonidova.
Elekt. Stantsii, 1958, No. 8, 61-3 (Aug). In Russian.

Tests on drying of model 400 kV power transformers in the tank have proved that, for simplicity and convenience, it is preferable to arrange the turns of the magnetizing winding directly along the beams. To obtain more uniform temperature distribution in the transformer tank and reduce the losses in the ambient medium the tank walls and cover should be carefully warmed irrespective of the ambient air temperature. The beams themselves need not be warmed.

Central Electricity Generating Board Digest

621.314.2 : 621.317.333

2684 DISTORTION OF THE VOLTAGE WAVE-FORM OF TESTING TRANSFORMERS RESULTING FROM HARMONICS IN THE MAGNETIZING CURRENT.
W.Matthes and R.Zahorka.
Elektrotech. Z. (E.T.Z.) A, Vol. 80, No. 19, 649-53 (Oct. 1, 1959). In German.

The testing transformers considered are high-voltage cascade-connected types using up to four stages. The effects on the h.v. wave-form of harmonics in the magnetizing current, combined with the relatively high self-capacitances and stray inductances of this type of transformer, are examined on theoretical grounds and the results confirmed by measurements and some oscillograms. The h.v. wave-form distortion is increased if the transformer is energized from a local alternator instead of supply mains of high load capacity. It is shown that distortion is minimized if the transformers are operated with moderate core flux densities and the load across the h.v. secondary is capacitive.

C.F.Pizzey

621.314.2

2685 A NOTE ON DISTRIBUTED IMPEDANCES AND OVER-VOLTAGES IN TRANSFORMER WINDINGS. A Pasi.
Energia elett., Vol. 36, No. 8, 692-712 (Aug., 1959). In Italian.

When transient conditions are being considered a transformer winding may be represented by a series of distributed impedances. A mathematical analysis is presented from which currents and voltages through the winding may be calculated and the correlation between the analytical and physical arrangement of the transformer winding is discussed. Some observations are made on the design of transformers as affected by impulse-voltage stresses.

M.Rathbone

621.314.2 : 621.316.91

2686 NOTES ON TRANSFORMER OPERATION. A.Bonomo.
Energia elett., Vol. 36, No. 9, 836-53 (Sept., 1959). In Italian.

A comprehensive account of maintenance routines and planned maintenance systems for transformers, with which is included details of protection against high temperature, oil failure, fire, and oil contamination for natural and forced cooling. Appendices include Italian standards for transformer oil, and methods of testing Buchholz relays. The article is illustrated with examples of current (Italian) practice.

621.314.2 : 621.317.333.8

2687 EXPERIMENTAL INVESTIGATIONS OF THE INSULATIONS OF THE INSULATION LEVEL WITH PULSE VOLTAGES ON THE NEW SERIES OF 110 kV TRANSFORMERS. D.Costina, A.Marx and B.Máthé.
Electrotehnica, Vol. 7, No. 11, 388-95 (Nov., 1959). In Rumanian.

To determine the insulation limit of high-voltage mains equipment, voltage impulse testing was carried out on transformers until insulation breakdown occurred. Knowing the safety margins, production costs of power transformers can be safely reduced. Results of this research have been applied to factory production techniques.

621.314.2 : 621.316.1

2688 THE DESIGN OF TRANSFORMERS FOR THE EUROPEAN 380 kV NETWORK AND INCOMING AUTO TRANSFORMERS. F.Coppadoro.
Industr. Ital. elettrotec., Vol. 12, No. 6, 209-16 (June, 1959). In Italian.

The increasing growth of 380 kV systems has reached the stage where useful comparisons may be drawn between alternative modes of transformer construction. An account is given of the general constructional problems together with details of magnetic circuits, windings, bushings and tanks. The use of auto-transformers for interconnection between 220 kV and 380 kV systems offers operational advantages but produces design problems as regards mechanical strength of the winding, variation in reactance with tap position, and impulse strength. The approach to these problems is outlined and illustrated by actual construction work. M.Rathbone

621.314.2

2689 AN ECONOMIC ANALYSIS OF DISTRIBUTION TRANSFORMER APPLICATION.
C.F.Mitchell, J.O.Sweeney and J.L.Cantwell.
Trans Amer. Inst. Elect. Engrs III, Vol. 78, 1196-202 (1959) = Pwr Apparatus Syst., No. 45 (Dec., 1959)

A computer-operated theoretical investigation into the operating costs of small transformers, with consideration of the effects of numerous factors, but in particular of insulation ageing. Curves are produced showing the cost per kVA plotted against annual peak load at transformer changeover (for the particular conditions, operating costs and system growth rates taken as typical for American operation), which indicate that changeover is most economically made when the peak load reaches about 160-170% of nameplate rating.

M.R.Dickson

621.314.2

2690 SWITCHING SURGE VOLTAGES DUE TO THE INTERRUPTION OF TRANSFORMER MAGNETIZING CURRENT. H.K.Amchin and R.T.Curto.
Trans Amer. Inst. Elect. Engrs III, Vol. 78, 1443-9 (1959) = Pwr Apparatus Syst., No. 45 (Dec., 1959).

This paper is based on published material of American and European origin, and is limited primarily to voltage classes of 100 kV and above, and to interruptions in the high-voltage winding of the transformer. Many conclusions are reached concerning the magnitude of surge voltages as affected by such factors as earthing conditions, system type and impedance, current interrupted, use of arresters, etc., but it is not found possible to determine a representative magnitude and waveshape for a surge resulting from interruption of transformer magnetizing current. M.R.Dickson

621.314.2

2691 VAPOUR-COOLED TRANSFORMERS... THEIR DEVELOPMENT AND PRESENT STATUS.
N.Narbut and G.A.Monito.
Westinghouse Engr, Vol. 19, No. 6, 162-6 (Nov., 1959).

In a vapour-cooled transformer, a suitable liquid is sprayed over the transformer core and coils inside a sealed tank; part of this liquid evaporates, and is condensed in a separate cooler for pumped recirculation. Heat is thus carried away from the core and coils largely through the latent heat of evaporation of the liquid; this gives very effective cooling, and practically limits the temperature of any surface in the transformer to the boiling point of the liquid. The use of fluorocarbons, particularly one termed FC - 75, is described and details of the physical and electrical properties are given. When cold, a transformer using the simple system described above has only low pressure in the tank, and insufficient electric strength for normal voltage operation; to avoid the need for a "preheating" system, a quantity of SF_6 is added. This gas provides the necessary dielectric strength when cold, but reduces the efficacy of heat transfer by the vaporization process. Two units, of 500 and 7500 kVA rating, have been produced commercially by this company, using FC - 75 plus SF_6. Constructional and operating details are given. M.R.Dickson

621.314.2

2692 VAPORIZATION COOLING FOR POWER TRANSFORMERS. P.Narbut, A.J.Maslin and C.Wasserman.
Trans Amer. Inst. Elect. Engrs III, Vol. 78, 1319-27 (1959) = Pwr Apparatus Syst., No. 45, (Dec., 1959).

See preceding abstr. More detailed information of the construction of the vapour-cooled, 7500 kVA transformer and of thermal tests carried out on this unit are given. M.R.Dickson

621.314.2 : 621.317.4

MEASUREMENTS ON ELECTRICAL SHEETS IN THE LABORATORY AND IN MANUFACTURE. See Abstr. 2142

621.314.2 : 621.318.132

ON THE DEPENDENCE OF MAGNETIC PROPERTIES OF ELECTRICAL SHEETS ON DIRECTION, AND THEIR MEASUREMENT. See Abstr. 2187

621.314.2 : 621.318.22

COLD-ROLLED TRANSFORMER SHEETS. See Abstr. 2186

621.314.212

2693 THE EFFECT OF OIL QUALITY ON THE INSULATION RESISTANCE OF TRANSFORMERS. T.Laszlo.
Energetica (Bucarest), Vol. 7, No. 12, 493-8 (Dec., 1959). In Rumanian.

A short description of a method for determining the humidity of transformer windings is given, followed by some new aspects regarding the behaviour of insulating oils. It is shown that low insulation resistance is due in many cases to changes in the oil and not to transformer humidity.

621.314.223

2694 CALCULATIONS FOR A THREE-PHASE AUTO-TRANSFORMER. R.Beyaert.
Electricien, Vol. 88, 7-11 (Jan., 1960). In French.

A step-by-step design of leading features for a 60 kVA 220/110 V 50 c/s furnace autotransformer. M.R.Dickson

621.314.224

2695 THEORY AND CALCULATION OF CURRENT TRANSFORMERS. A.Rauth.
Electricien, Vol. 87, 239-245 (Dec., 1959). In French.

After general remarks about the application and use of current transformers, the theory is dealt with. It appears that errors will always be present, especially phase errors between primary and secondary current. A summary is given of the expressions required to design a current transformer with a toroidal magnetic system. A numerical example is worked out for a transformer with $I_1 = 100$ A, $I_2 = 1$ A and a secondary power of 3.5 VA.

POWER CONVERSION

621.314.5

2696 TRANSISTOR THREE-PHASE D.C.–A.C. INVERTER. Mullard tech. Commun., Vol. 5, 78-80 (Feb., 1960).

A method of operating transistors in a self-oscillating three-phase circuit is described. The transistors operate in a switching mode to give high-efficiency power conversion, the output waveform being a 2 : 1 square wave to provide a balanced system.

621.314.57

2697 SIMPLIFIED DESIGN OF PUSH-PULL TRANSISTOR INVERTERS. A.Haug.
Radio Mentor, Vol. 25, No. 12, 964-6 (Dec., 1959). In German.

Outlines a method of estimating the switching waveforms, assuming the primary inductances of the transformer windings to be constant over the current ranges involved. A numerical example of a complete inverter design is worked out. F.F.Roberts

621.314.6

2698 OPERATION OF RECTIFIERS IN THE TRANSIENT REGIME. A.R.Gabard.
Bol. Fac. Ingen. Montevideo, Vol. 7, No. 1, 1-11 (Feb., 1959). In Spanish.

For continuous and discontinuous conduction of arc rectifiers the transfer functions relating the control signal (rectifier grid voltage) and the rectifier output current as a function of the frequency of the former are determined. For operation with discontinuous conduction the transfer function is shown to be a constant if the control signal frequency is much less than the supply frequency. The system operates as a frequency-changer if the control frequency approaches the supply frequency. For continuous conduction the ratio of output current to control voltage is shown to be $K/(R + J\omega_c L)$ where K is a constant, R and L are load circuit constants, and $\omega_c \ll \omega$, the supply frequency. Oscillograms of control voltage and output current for frequencies of 8.33 and 53.3 c/s are given. An example of speed control of a d.c. motor, the armature of which is fed from a grid-controlled rectifier, is given and the transfer function relating motor speed to control voltage is derived. Experimental and theoretical results for such a system are given. V.S.Young

621.314.6

2699 DURATION OF TRANSIENTS IN CIRCUITS WITH THREE-PHASE BRIDGE RECTIFIERS.
V.D.Krochakevich.
Elektrichestvo, 1959, No. 12, 61-3 (Dec.). In Russian.

An examination is made of the deficiencies of single-phase rectifiers used for supplying d.c. to systems of protection and automatic control. These disadvantages are not present where a three-phase bridge system of rectification is used. The operation of such a system is analysed by means of equivalent circuits and it is shown that, by appropriate selection of the system parameters, it is possible to vary the duration of the transients in it within wide limits. The operation of the apparatus supplied with the rectified current can be greatly accelerated.
Associated Electrical Industries (Manchester)

621.314.62

2700 CALCULATION OF THE DURATION OF THE CURRENT DELAY OF MODERN RECTIFIERS. Z.Křesadlo.
Elektrotech. Obzor, Vol. 48, No. 12, 621-30 (1959). In Czech.

An essential part of contact rectifiers is the non-linear commutating reactor. The relation for the duration of the current delay on interruption, as determined by the reactor properties is derived, and the time delay is calculated with the help of nomograms. Extreme cases of current-delay duration are obtained and the choice of suitable delay time is considered. Finally the duration of the delay on connection is determined. Calculated examples illustrate the theory. N.Klein

621.315.626

2701 CORETTES: MODELS FOR OBTAINING ELECTRICAL DATA ON INSULATION FOR BUSHINGS. R.D.Alvord.
Trans Amer. Inst. Elect. Engrs III, Vol. 78, 1029-32 (1959) = Pwr Apparatus Syst., No. 45 (Dec., 1959).

Impulse and power-frequency breakdown tests are made on models of impregnated-paper bushings in which all the dimensions except paper thickness and number of layers between equalizer electrodes are scaled down. Due to economy in materials and effort, a larger number of samples can be tested to obtain statistically significant results. Examples given include an evaluation of papers of different densities and different numbers of layers. Numerical values of breakdown strength are not quoted. K.W.Plessner

621.314.65

2702 SINGLE-PHASE IONIC RECTIFIER WITH TWO-STAGE ANODE VOLTAGE. O.A.Maevskii.
Elektrichestvo, 1959, No. 4, 49-55 (April). In Russian.

The proposed method may be used singly or in groups (up to five) to increase the efficiency of traction systems. It allows better engine-speed regulation with higher efficiency without additional elements such as contactors, compensating capacitors etc. The derived theoretical formulae lead to the graphs used in the design of the rectifier. They give the coefficient of phase, distortion, energy, and form as a function of voltage regulation. For four groups of two-stage rectifiers, for voltage regulation down to 20%, an efficiency exceeding 80% is achieved. M.W.Makowski

621.314.65

2703 THE PROSPECTS OF USING SERIES-CONNECTED RECTIFIERS AT LOW VOLTAGES. L.S.Fleishman.
Elektrichestvo, 1959, No. 9, 61-6 (Sept.). In Russian.

This connection is preferred in traction substations since, without impairing efficiency, it allows a substantial increase of load per unit valve and at the same time sharply decreases the incidence of backfiring. The method has been proved both technically and economically sound and is now applied in a new 9.9 MW, 3.3 kV rectifier set working on the principle of a six-anode unit with phase equalizer; two valves are used in series for each arm. E.M.Dembinski

621.314.65

2704 ON THE MOTION OF THE CATHODE SPOT. A. Kloss.
Elektrotech. Obzor, Vol. 48, No. 12, 634-8 (1959). In Czech.

Discusses briefly new work on the cathode spots in mercury-arc rectifiers. Qualitative observations on the motion of the spot in an ignitron are described. The observations relate to the mutual influence of current magnitude at the auxiliary electrodes and in the main arc on the motion. The effect of cathode-spot location and voltage drop on the arc was investigated also. It is concluded that position and motion of the spot are determined by the magnetic fields of the arcs, which can stabilize the spot of an auxiliary arc. N.Klein

POWER TRANSMISSION
OVERHEAD LINES . CABLES

621.315.1

2705 INFLUENCE OF INTERMEDIATE POWER TAKE-OFF ON ECONOMY OF LONG-DISTANCE TRANSMISSION.
N.N.Krachkovskii.
Elektrichestvo, 1959, No. 12, 28-32 (Dec.). In Russian.

It is concluded that d.c. power transmission at extra-high voltage for distances of 1000 km upwards shows a considerable saving over a.c., whether with or without intermediate take-off of power. Central Electricity Generating Board Digest

621.315.1 : 537.52

2706 EFFECT OF CORONA ON TRAVELLING WAVES. M.Ouyang.
Nature (London), Vol. 185, 524-5 (Feb. 20, 1960).

Observations of wave shape distortion along a 33 kV overhead line suggest that the corona discharge is quenched by its own space charge. C.G.Morgan

621.315.17

2707 POWER TRANSMISSION AT EXTREMELY HIGH VOLTAGE. A.Goldstein and W.Frey.
Brown Boveri Rev., Vol. 46, No. 4, 227-50 (April, 1959).

A project study for the transmission of 2000 MW over 800 miles presented the opportunity of working out a scheme with a maximum line voltage of 650 kV. The equipment visualized is described and the principles of stability and compensation of very long lines are explained. A compensator would comprise a series capacitor and shunt reactor. The study indicated that the project was quite feasible. A.P.Wilmshurst

621.315.17

2708 SPLIT-PHASE OPERATION OF 400 kV LINE UNDER ICING CONDITIONS. P.A.Dolin.

Elekt. Stantsii, 1958, No. 8, 63-6 (Aug.). In Russian.

From a study of the icing conditions on conductors of a 400 kV system it is concluded, inter alia, that ice deposits on windward-exposed split-phase lines are heavier and form more quickly than those on the third screened line, involving a stress difference of 25%. The total weight of the deposits on the split-phase, consisting of three conductors, is less than three times the weight of the deposit on a single conductor. With increase in the ice load the difference widens, reaching 20%. With increase in the suspension height the weight of the ice deposits on the conductor increases about 3% for each metre of height above 7.5 m.

Central Electricity Generating Board Digest

621.315.17

2709 THE FRENCH 380 kV ELECTRICITY SUPPLY NETWORK. THE LE MARQUIS–MARMAGNE LINE. H.Petit.

Tech. mod., Vol. 52, No. 1, 1-7 (Jan., 1960). In French.

A description of the first French supply line constructed directly for carrying energy at 380 kV. The line runs from Le Marquis to Marmagne; it has recently been put into service under a provisional voltage of 225 kV, but will be used for 380 kV supply in 1961. This will involve no modification other than the connection at the terminal station. The line includes 648 pylons, fitted with 6 aluminium–steel conductors with a cross-section of 595 mm^2 (0.922 in^2) with two conductors per phase. The average span between pylons is 503 metres (1 650 ft). The maximum span is 1 095 metres (3 591 ft). The main characteristics of the equipment are described, with special reference to the pylons, which were specially designed and incorporate an upper beam carrying one or two central conductors and two brackets placed slightly lower, each of them carrying one or two lateral conductors; this is known as the "cat" type of pylon. The foundations, erection of the framework, unwinding of the conductors, etc. are discussed.

621.315.17

2710 FACTORS AFFECTING VIBRATORY STRESSES IN CABLES NEAR THE POINT OF SUPPORT. R.F.Steidel, Jr.

Trans Amer. Inst. Elect. Engrs III, Vol. 78, 1207-13 (1959) = Pwr Apparatus Syst., No. 45 (Dec., 1959).

The wind-induced vibration of cables is the source of numerous fatigue failures in strands of electric transmission-line cables. At present, the emphasis in the field is directed at reducing or eliminating the amount of vibration by adding dampers and vibration absorbers rather than at reducing the induced stress in the cable by rational design of the suspension system. This paper is directed towards the evaluation of factors affecting the actual stresses or strains in a vibrating cable. The cable is considered to have both flexural rigidity and axial tension. Solutions for the bending stresses were derived for the dynamic case using the methods of standard beam theory. A static solution of the bending stresses is presented using the standard design criteria. The action of the suspension clamp, in the dynamic solution, is interpreted in terms of a factor ξ, which is introduced to represent how nearly the suspension clamp approaches the pinned suspension $\xi = 1$, rather than a rigid suspension $\xi = 0$. The pinned suspension would result in a point of zero reversed stress at the suspension clamp.

621.315.17

2711 DESIGN OF OVERHEAD LINES WITH 5005 ALUMINIUM ALLOY CABLES. H.W.Adams.

Trans Amer. Inst. Elect. Engrs III, Vol. 68, 1290-300 (1959) = Pwr Apparatus Syst., No. 45 (Dec., 1959).

Cables made of 5005 aluminium alloy provide tensile strength about midway between aluminium and steel-cored aluminium conductors and will, it is believed, meet the technical requirements of the vast majority of lines for which any strong aluminium alloy cable may be suitable. Characteristics of conductors of 5005 alloy are given and compared with those of electrical-conductivity-grade aluminium, steel-reinforced aluminium and hard-drawn copper. It is concluded that homogeneous cables made of 5005 aluminium alloy have properties and sag characteristics that make them specially suitable for overhead lines having span lengths in the range normally encountered in urban areas. H.A.Miller

621.315.17

2712 ELECTROMAGNETIC UNBALANCE OF UNTRANSPOSED TRANSMISSION LINES. III. DOUBLE CIRCUIT LINES. E.T.B.Gross, J.H.Drinnan and E.Jochum.

Trans Amer. Inst. Elect. Engrs III, Vol. 78, 1362-71 (1959) = Pwr Apparatus Syst., No. 45 (Dec., 1959).

For Pt II, see Abstr. 79 (1956). This part includes a study of the electromagnetic unbalance of double-circuit lines with and without single or double earth wires. The mutual-sequence impedance values between conductors for any one of 18 different phase arrangements possible for a double 3-phase circuit, are included. Eight independent factors are required to cover all possibilities, provided no earth wire is used. The addition of earth wires introduces fairly simple correction factors to all mutual sequence terms. Examples which illustrate the use of the formulae for two different phase configurations yielding maximum and minimum voltage unbalance, and for two geometrical arrangements are given. Both arrangements of conductors and both sequence positions lead to small unbalance currents.

621.315.171

2713 TRANSPOSITION OF CONDUCTORS. D.Lafont.

Bull. Soc. Franc. Elect., Vol. 9, 759-67 (Dec., 1959). In French.

Details of the French regulations and the practices adopted in Germany, Sweden, Italy and Finland. Drawings of transposition arrangements and towers are included. P.Linton

621.315.2

2714 CHOICE OF OPTIMUM CROSS-SECTION FOR POWER CABLES. J.Baudoux.

A.C.E.C. Rev., 1959, No. 4, 22-8.

The theory is summarized and nomograms are given to assist in choice of the optimum dimensions with respect to: (a) temperature rise; (b) voltage drop; and (c) cost. V.G.Welsby

621.315.2 : 621.315.615

NON-DRAINING COMPOUNDS AND NON-DRAINING CABLES. See Abstr. 2109

621.315.2 : 621.317.333.6

INSULATION TESTS FOR SHORT LENGTHS OF CABLES ON THE BASIS OF DISCHARGE MEASUREMENTS. See Abstr. 2120

621.315.211.2

2715 A 35 Kv POLYETHYLENE-INSULATED CABLE INSTALLATION. G.J.Crowdes.

Trans Amer. Inst. Elec. Engrs III, Vol. 78, 1086-92 (1959) = Pwr Apparatus Syst., No. 45 (Dec., 1959).

Describes the design, manufacture and installation of half a mile of 3 single-core cables inserted in a long line designed to carry 20 MVA. The cables are partly buried and partly aerial. The cable has been in satisfactory service for two years, during which time there have been 4 outages to the line due to lightning.

A.P.Wilmshurst

621.315.211.9

2716 EDMONTON INSTALLS CANADA'S FIRST OIL-FILLED PIPE CABLE SYSTEM. C.Z.Monaghan and W.J.Pardy.

Engng J., Vol. 42, No. 12, 48-53 (Dec., 1959).

Describes the system, the design of the 72 kV cable and accessories, the installation and acceptance testing. Service experience to date is discussed and reference is made to operating conditions and maintenance procedures.

621.315.285

2717 LAYING 170 kV SUBMARINE CABLE IN DENMARK.

Elect. J., Vol. 164, No. 6, 353-4 (Feb. 5, 1960).

A note briefly describing the design and installation of a 215 MVA 3-core, flat-type, oil-filled cable across the Kolding Fjord.

V.G.Welsby

621.315.285

2718 THE ST. LAWRENCE RIVER HIGH-VOLTAGE SUBMARINE CABLE CROSSING.

D.M.Farnham, G.B.Shanklin, S.H.Cunha and H.D.Short.

Trans Amer. Inst. Elect. Engrs III, Vol. 78, 1098-185 (1959) = Pwr Apparatus Syst., No. 45, (Dec., 1959).

Contains four papers, dealing respectively with basic design, manufacture and testing of cables, installation, final tests. A detailed description is given of the many difficulties which had to be

overcome in carrying out a project of this nature. Valuable experience was gained in the handling of heavy submarine cables in water depths up to 200 fathoms. The length of the sea crossing is about 30 nautical miles. V.G.Welsby

INSULATORS
SUPPORTS . CONNECTIONS

(See also Insulating Materials)

621.315.624

2719 THE BEHAVIOUR OF 20 kV INSULATOR SUSPENSION ASSEMBLIES SWINGING UNDER WIND PRESSURE. W.Philipps.
Elektrizitatswirtschaft, Vol. 58, No. 13, 452-4 (July 5, 1959). In German.

Field experience with 20 kV lines and verified by experiment shows that present V.D.E. methods of attaching rod-type insulators to the crossarm provide insufficient clearance under wind conditions between live and earthed line parts. New fittings are developed for both single and double assemblies which obviate this defect. E.M.Dembinski

621.315.668.2 : 621.316.99

DEEP EARTHING FOR TOWER FOOTINGS. See Abstr. 2085

621.315.682 : 621.316.351

2720 DESIGN AND ANALYSIS OF AN UNPLATED HIGH-PRESSURE LIMITED-AREA BOLTED ELECTRIC JOINT: A METHOD OF CALCULATING VARIOUS COMPONENTS OF JOINT RESISTANCE. R.K.Allen.
Trans Amer. Inst. Elect. Engrs III, Vol. 78, 1047-53 (1959) = Pwr Apparatus Syst., No. 45 (Dec., 1959).

Joint resistance may be divided into three major components: (1) resistance of the basic metal or ordinary ohmic or body resistance; (2) resistance resulting from surface tarnish films trapped between the members of the joint (film resistance); (3) resistance due to the converging of the lines of current flow as they pass through the small "true conducting" area of the joint (constriction resistance). Difficulties involved in assessing the quality of a joint include the effect of tarnish films and the presence of uneven protuberances or asperities. A joint having unusual geometry is described which gives superior performance over a flat-on-flat joint on tarnished conductors because the high-pressure scrubbing action resulting from the unusual geometry converts a greater portion of the load-bearing area. This design gives additional flowed-wiping action, thus lessening film resistance, and the geometry is such that constriction resistance is also reduced. A method of calculating joint resistance is given in an appendix. H.A.Miller

621.315.682

2721 LABORATORY AND FIELD EVALUATION OF CONNECTORS AND OTHER ACCESSORIES FOR ALUMINUM CONDUCTORS IN SEVERE MARINE ENVIRONMENTS. W.J.Sanders.
Trans Amer. Inst. Elect. Engrs III, Vol. 78, 1342-53 (1959) = Pwr Apparatus Syst., No. 45 Dec., 1959).

Describes a programme of tests and field studies initiated mainly with the objects of evaluating and appraising available commercial accessories for use with aluminium conductors and developing new types of fittings suitable for aluminium conductors in the most severe environments. The tests showed that (1) platings on a connector only increase the damaging effects of galvanic corrosion; (2) bronze and copper body connectors are not suitable for use with aluminium conductors in severe marine environments; (3) split-bolt type connectors tend to be weak and do not provide the spring action required to absorb thermal shocks and maintain a stable connection; (4) parallel-groove type connectors will provide a satisfactory connection for aluminium conductors providing that the design of the connector shields the conductor from contacting the steel bolt directly or through a narrow salt bridge; (5) aluminium bolts eliminate the problem of conductor attack from the inside of the connector; (6) compression type connectors will provide satisfactory and serviceable connections if the design is such that contact area and degree of compression are adequate; (7) the use of contact sealing paste or grease is an advantage. H.A.Miller

621.315.687

2722 CABLE JOINTS AND TERMINATIONS. H.Flack.
Elect. J., Vol. 164, No. 8, 500-1 (Feb. 19, 1960).

Current practice in relation to the design and jointing techniques used in connection with joints and terminations on paper-insulated cables from 11 kV to 132 kV is described. The design of insulation, fully screened joints, migration path, filling compounds, terminal boxes and conductor fitting are considered. Central Electricity Generating Board Digest

DISTRIBUTION . INSTALLATIONS

621.316.1

2723 SOME CONSIDERATIONS ON THE PLANNING OF DISTRIBUTION NETWORKS IN A METROPOLITAN AREA. L.Arzone.
Energia elett., Vol. 36, No. 9, 788-95 (Sept., 1959). In Italian.

A brief account of the various types of urban load encountered is followed by details of load prediction. A comparative analysis is made of networks having open ring-mains and solid interconnections together with an account of the methods of supply for tall buildings. M.Rathbone

621.316.1

2724 FAULTS ON [POLISH] OVERHEAD LINES. W.Heller.
Energetyka (Poland), Vol. 13, No. 4, 98-100; No. 5, 126-7 (1959). In Polish.

Statistics of faults for 1955-57 are given. Figures are given for 100 km lengths of line for six voltage groups — 220, 100, 60, 40-30, 20-15 and 10-2 kV. The causes are divided into external and internal. The external causes were : (1) atmospheric discharges (47%); (2) hurricanes (11%); (3) icing (3%); (4) frost (5%); (5) fog (0.5%); (6) birds (6%); and (7) third parties (11%). The internal causes were : (1) ageing (11%); (2) constructional defects (1.2%); (3) overhaul and mounting (2.5%); (4) in use (1.8%); and (5) unknown (1.8%). M.W.Makowski

621.316.1 : 621.314.2

DESIGN OF TRANSFORMERS FOR THE EUROPEAN 380 kV NETWORK AND INCOMING AUTO TRANSFORMERS. See Abstr. 2686

621.316.11

2725 APPROXIMATIONS INTRODUCED BY THE USE OF EQUIVALENT CIRCUITS WHEN CALCULATING STATIONARY CONDITIONS AND STATIC STABILITY OF ELECTRIC NETWORKS. E.Arie and S.Ionescu.
Stud. Cercetari Energetica, Vol. 7, No. 4, 709-45 (1957). In Roumanian.

621.316.13

2726 IMPROVING PERFORMANCE OF DISTRIBUTION SYSTEMS. R.W.Langley.
Elect. Times, Vol. 137, No. 7, 239-42 (Feb. 18, 1960).

Measures which are being taken by the South Eastern Electricity Board to improve rural distribution on systems up to 33 kV and make it comparable in reliability with the supply in towns are described. These measures include improved tree-cutting techniques, fitting of auto-reclosers, use of repeater fuses, line conversion, overvoltage protection and use of arc-suppression coils. G.V.Hargreaves

621.316.13 : 621.317.333.41

2727 PREVENTIVE TESTING OF 6-10 kV NETWORKS UNDER LOAD. G.M.Shalyt.
Elekt. Stantsii, 1958, No. 8, 66-70 (Aug.). In Russian.

Surveys deficiencies in existing methods for preventive testing of cable line insulation in service; the utility of fixing temporary breakdown zones to avert sudden disconnections; and preventive testing under load. Zone fixation and testing under load curtail the amount of operational switching in systems and sharply reduce time and labour expenditure on the execution of testing, while improving system efficiency. Central Electricity Generating Board Digest

621.316.13

2728 REPRESENTATIVE SYMMETRICAL AND RESULTANT VECTORS FOR 3-PHASE NETWORK STUDIES. F.Manea.
Electrotehnica, Vol. 7, No. 5, 155-8 (May, 1959). In Rumanian.

The use of symmetric representative vectors enables the study of three-phase networks to be made in unsymmetrical and non-sinusoidal transient operating conditions. The equations of a network consisting of a generator and an RLC line are given. The limits of the validity of classical methods of symmetrical components are indicated and an example is solved.

621.316.15

2729 RURAL DISTRIBUTION (IN SWEDEN). C.Hageon.
Svenska Vattenkr Fören, Publ. Medd., No. 158 (1960 : No. 3), 1-28 In Swedish.

A statistical and economic survey. There are almost 10^6 rural consumers in Sweden, the number increasing by about 2% per year. Distribution is handled by nearly 2000 undertakings, most of which have only 50-500 consumers. The most common form of undertaking is the distribution society. About 30% of the undertakings generate their own power. 99% of rural areas are now electrified. State and communal undertakings are shown on a map of the country.
G.N.J.Beck

621.316.35

2730 ALUMINIUM BUS BARS. G.Dassetto.
Bull. Assoc. Suisse Elect., Vol. 51, No. 1, 2-14 (Jan. 16, 1960). In French.

Summarizes the characteristics of aluminium and copper as materials for the construction of busbars and discusses the factors which determine the cross-sectional area required to carry a given current. A formula is developed which takes all these factors into account and a table is reproduced showing the electrical and physical properties of aluminium conductors of varying sizes. Emphasis is given to the effect of different aluminium sections on heat dissipation and resistance to physical loads imposed under short-circuit conditions, with particular reference to the advantages of a double "T" over the double "L" or double "U" sections more commonly used. Concludes with advice on the most suitable methods of making aluminium–copper and aluminium–aluminium joints. D.R.Way

SWITCHGEAR

621.316.5

2731 SWITCHING CURRENT DURING INTERRUPTION OF ONE OF TWO PARALLEL CIRCUITS OF ELECTRICAL APPARATUS.. N.N.Nikiforovskii.
Elektrichestvo, 1959, No. 12, 70-4 (Dec.). In Russian.

On the breaking of one of two parallel circuits of the main contacts of electrical apparatus an arc is formed if the voltage at the separated contacts becomes greater than the arc ignition voltage. The features of the process and duration of current change after arc formation are studied and the power dissipated during arcing is calculated. Central Electricity Generating Board Digest

621.316.543

2732 MICRO SWITCH SELECTION. B.A.Holden and J.F.Dodds.
Elect. Rev., Vol. 166, No. 7, 293-6 (Feb. 12, 1960).

The performance of microswitches varies with the conditions under which they are operated. Taking extreme conditions, it may be a sensibly infinite force such as a cam with controlled movement or it may be an increasing force with uncontrolled movement such as bellows or springs. These variations are discussed and illustrated by diagrams. Snap action, repeat accuracy and life are of primary importance but cost, size and method of mounting etc. are considered to be only secondary. Change-over time may be affected by circuit conditions causing contact resistance or welding and contact pressures have to be adjusted to suit the type of contact material. The correct approach to design is discussed and it is pointed out that since the release force and contact pressure are fundamental to the switch design, it is preferable to try and alter the working conditions to suit the switch rather than design special switches. Photos and drawings of several switches are given. B.B.Austin

621.316.546

2733 THE CONSTRUCTION AND WORKING OF A NEW TYPE OF AN ELECTROLYTIC INTERRUPTER. L.Lal.
J. sci. Res. Banaras Hindu Univ., Vol. 8(2), 136-44 (June, 1958).

This type, intermediate between the Wehnelt and the Caldwell and Simon, consists of two similar cylindrical lead rods dipped in dilute H_2SO_4 contained in a large glass cylinder. The anode lead rod carries a small platinum wire and is enclosed in a glass tube having a small hole at its lower extremity to allow communication through it with the rest of the reservoir. The design of the various parts is considered in detail, working values are stated, and its method of operation described. 4 references. E.F.Hansford

621.316.57

2734 THE H.V. AIR-BLAST CIRCUIT-BREAKER AND RATES OF RISE OF RESTRIKING VOLTAGE WITH SHORT CIRCUITS NEAR A STATION. L.Orgeret and J.Renaud.
Bull. Soc. Franc. Elect., Vol. 9, 724-44 (Dec., 1959). In French.

Outlines general circuit-breaking conditions and the behaviour of oil and of air-blast circuit-breakers in various circumstances and especially when faults are near a station (défaut kilometrique). The effect of r.r.r.v. is much more pronounced in the case of air-blast circuit-breakers than for oil circuit-breakers and means to cope with the danger zone (where failures to clear are likely) are described. Several high-power test results are included with curves illustrating various features. Though air-blast circuit-breakers can operate successfully in the worst conditions some care is necessary to ensure that they do, and recommendations are made that the French regulations should be revised to take account of this.
A.P.Paton

621.316.57 : 621.316.923

2735 DISCRIMINATION BETWEEN H.R.C. FUSES AND MINIATURE CIRCUIT-BREAKERS. H.D.Einhorn.
Proc. Instn Elect. Engrs, Monogr. 345 U, publ. Oct., 1959 (Vol. 107C, 75-81).

Republication of the monograph abstracted in Abstr. 113 (1960).

621.316.57.064.25

2736 A LINE OF OUTDOOR SINGLE-TANK OIL CIRCUIT BREAKERS FOR 14.4 kV THROUGH 46 kV SERVICE. C.J.Balentine.
Trans Amer. Inst. Elect. Engrs III, Vol. 78, 1032-8 (1959) = Pwr Apparatus Syst., No. 45 (Dec., 1959).

The advantages of enclosing 3 ph. oil circuit-breakers in one tank are briefly noted and the main constructional features of a range of this type from 14.4 kV and 1 000 MVA to 46 kV, 1 500 MVA are described. Illustrations and oscillograms depict some of the main features and the results of proving tests for opening, reclosing and duty cycles showing reliability of performance and 5 cycle operation in a field where 8 cycle operation is now the standard.
A.P.Paton

REGULATION

621.316.71

2737 ELECTRONICALLY CONTROLLED DRIVES. I.Földi.
Bull. Oerlikon, No. 333, 26-41 (April); No. 334, 46-56 (June, 1959).

Describes advantages and some applications of electronic motor control, followed by a detailed description of the operation of armature controlled drives and controlled Ward Leonard drives. Essential operational characteristics are discussed, such as constancy of speed, quality of control, efficiency, etc., and finally a newly developed series of electronically controlled drives is briefly described.

621.316.71 : 621.34

D.C. DRIVES FOR WINDERS. See Abstr. 2095

621.316.718 : 621.375.3

2738 SUPPLYING A D.C. MOTOR DIRECTLY THROUGH A MAGNETIC AMPLIFIER. A.Zerbini.
Marelli, Vol. 33, No. 1-6, 13-25 (June-July, 1959). In Italian.

The conventional methods of controlling d.c. motors (Ward Leonard) and a.c. motors (Schrage) are described. The use of magnetic amplifier with a 3-phase commutator motor is to be preferred

because of the greater range of control and the possibility of incorporating the controller in a servo loop. An advantage over the Ward Leonard system is the elimination of two rotating machines. The principles of magnetic amplifiers are described and equivalent circuits deduced, using fictitious machines, which enable the analysis of complete control loops. An example is given, qualitatively, of the design of a control system and mention is made of stabilization against factors other than the load. S.C.Dunn

621.316.713 : 621.34

A NEW FORM OF CRANE-HOIST CONTROL USING A 3:1 POLE-CHANGING INDUCTION MOTOR. See Abstr. 2101

621.316.718.1

2739 OPTIMIZATION OF SPEED REGULATION OF A KAPLAN TURBINE, TAKING ACCOUNT OF THE EFFICIENCY CURVE AND INHERENT STABILITY.

I. G.Ransford and J.Rottner; II. G.Ransford.

Houille blanche, Vol. 14, No. 6, 762-77 (Nov., 1959); Vol. 15, No. 1, 22-30 (Jan.-Feb., 1960). In French and English.

621.316.718.5

2740 MOTOR SPEED STABILIZATION CIRCUIT HAS THREE-WINDING TRANSFORMER.

O.B.Rosenbauli and R.N.Rodin.

Avtomat. i Telemekh., Vol. 20, No. 3, 318-22 (1959). In Russian.

A speed stabilization circuit for a.c. and d.c. motors using a special three-winding transformer is considered. The theory of the circuit suggested is applied to independent-excitation d.c. choke drive.

621.316.718.5

2741 ELECTRONIC SPEED REGULATION SYSTEM FOR A VARIABLE SPEED ASYNCHRONOUS INDUCTION MOTOR. C.Curie.

C.R.Acad. Sci. (Paris), Vol. 249. No. 23, 2517-19 (Dec. 9, 1959). In French.

In Abstract 993 (1956) the principle of speed regulation using gas-filled rectifiers and thyratrons was recalled. This note describes the operation of an electronic regulating circuit now included to improve the speed stability with varying loads. Rectified voltages proportional to the p.d. at the rotor terminals are compared with a reference voltage and the difference applied to the grid of a valve. To the cathode is connected a rectified voltage proportional to the load current, to compensate for the varying rotor IR drops. The plate voltage of this valve is thus proportional to the rotor speed at all loads, and is applied through a cathode-follower circuit to the grids of the thyratrons controlling the motor. A current-limiting device operates at excessive rotor currents. A 35 h.p. 3000 rev/min laboratory model achieved a speed regulation from 4% to 0.7% while operating from zero to full load. E.F.Hansford

621.316.718.5

2742 CALCULATION OF STATIC SPEED CHARACTERISTICS FOR A CONTROLLED MERCURY-ARC RECTIFIER–MOTOR SYSTEM. E.N.Zimin.

Elektrichestvo, 1959, No. 12, 39-46 (Dec.). In Russian.

Describes a modern non-reversible variable drive based on the mercury-arc rectifier–motor system and examines the features involved in the calculation of the speed characteristics for different versions. Systems with negative speed-feedback, negative voltage-feedback combined with positive current-feedback, and negative speed-feedback with positive current-feedback are all treated. An example is given of the method proposed for calculating the speed characteristics of such systems.

Associated Electrical Industries (Manchester)

621.316.719.2

2743 ELECTROMAGNETIC BRAKE WITH EDDY CURRENTS. N.Bichir.

Electrotechnica, Vol. 7, No. 7, 249-59 (July, 1959). In Rumanian.

Theoretical considerations on the operation of the electromagnetic brake are given. Design relationships are derived analytically for disk brakes of nonmagnetic metal. Methods of calibration are discussed and the use of the brake to measure motor torque is described.

621.316.72

2744 EXCITATION REGULATION AND STABILITY OF POWER STATION GENERATORS WORKING ON TWO SYSTEMS.

M.P.Kostenko, V.E.Kashtelyan, N.S.Sirÿi and G.R.Gertsenberg.

Elektrichestvo, 1959, No. 12, 1-9 (Dec.). In Russian.

The results are presented of investigations into the principle of excitation regulation responding to variation of frequency and its first derivative; different types of excitation regulation responding to the line current in the transmission of power from a station in two directions; and the static and dynamic stability in these conditions. Details are given of the model used for the investigations, based on the operation of the Volga power station for the two transmission lines to Moscow and the Urals. Separate and parallel operation of the generators is considered. It is shown that excitation regulation responding to frequency variation has valuable operating advantages. Associated Electrical Industries (Manchester)

621.316.72 : 621.313.322-81

2745 POSSIBLE LINES OF DEVELOPMENT FOR AUTOMATICALLY REGULATED TURBO-GENERATOR EXCITATION SYSTEMS. Ya.N.Shtrafun.

Elektrichestvo, 1959, No. 12, 10-13 (Dec.). In Russian.

The following systems are examined: semiconductor power rectifiers; uncontrolled power-compounding; controlled phase-sensitive power-compounding; thermionic excitation fed from a high-frequency source; and the combination of thermionic excitation with power compounding. The advantages and disadvantages of each system under different conditions are indicated.

Associated Electrical Industries (Manchester)

621.316.721

2746 CURRENT STABILIZERS USING TRANSISTORS. G.Faini and R.Pesaresi.

Alta Frequenza, Vol. 28, No. 1, 60-6 (Feb., 1959). In Italian.

Gives details and performance characteristics of transistor stabilizing circuits for the ionization current of an r.f. mass spectrometer and for the anode current of a noise diode. F.F.Roberts

621.316.721 : 537.3

2747 HIGH PRECISION LARGE CURRENT REGULATOR. K.C.Brog and F.J.Milford.

Rev. sci. Instrum., Vol. 31, No. 3, 321-2 (March, 1960).

A versatile high current regulator using transistors for the series regulating element and capable of accuracies of a few parts per million is described. A solid state d.c. power supply capable of delivering 50 A at 50 V also is described. The performance of the system as a magnet current regulator is discussed briefly.

621.316.722 : 621.375.3

2748 A METHOD OF ANALYSIS AND CALCULATION OF TRANSIENT PROCESSES IN THE AUTOMATIC REGULATION OF GENERATOR EXCITATION BY MEANS OF MAGNETIC AMPLIFIERS. V.R.Kulikov.

Avtomat. i Telemekh., Vol. 19, No. 6, 564-73 (1958). In Russian. English summary: PB 141096T-5, obtainable from Office of Technical Services, U.S.Dept. of Commerce, Washington, D.C., U.S.A.

621.316.722

2749 THE REGULATION OF RANDOM VOLTAGE FLUCTUATIONS IN ELECTRICAL SYSTEMS. P.Gaussens.

Bull. Assoc. Suisse Elect., Vol. 50, No. 26, 1271-9 (Dec. 19, 1959). In French.

A theoretical statistical study is followed by a suggested scheme for a relative deviation representation based on active and reactive power at the supply point. A network employing this system has been tested; optimum results were achieved with 17 transformer taps of 1.5% each. P.Linton

621.316.728 : 621.311.161

ECONOMICS OF CENTRALIZED CONTROL OF ELECTRIC GENERATING PLANTS. See Abstr. 2635

621.316.722

2750 ON THE REALIZATION OF A D.C. POWER SUPPLY WITH GREAT STABILITY AND WIDE RANGE OF OUTPUT VOLTAGE. G.Giralt and J.Lagasse.

C.R. Acad. Sci. (Paris), Vol. 250, No. 1, 91-3 (Jan. 4, 1960). In French.

The principle of operation of a stabilized power supply incorporating two feed-back loops where the output voltage can be controlled over a wide range is discussed. The principle properties of the device are deduced from transfer functions. A brief account of standard practice for stabilized supplies is given and details of the authors' contribution are described. It is claimed that their

design overcomes one major difficulty in stabilized power supplies with wide range of output-voltage control, namely that large variations in the output voltage cause the regulator to work under unfavourable conditions. A.C.Brown

621.316.722

2751 ON THE STABILIZATION OF D.C. POWER SUPPLIES. E.Cassignol, G.Giralt and Y.Sevely.
C.R. Acad. Sci. (Paris), Vol. 250, No. 7, 1218-20 (Feb. 15, 1960).

Equivalent circuits are given for a system with a series stabilizer controlled by a comparator amplifier. The function of a capacitor across the output to modify the Nyquist diagram, and the insertion of phase-correcting networks to ensure stability with all forms of passive loads is discussed. It is pointed out that the correcting network enables a smaller output capacitor to be used. W.G.Stripp

621.316.722

2752 SOLID-STATE GENERATOR REGULATOR FOR AUTOS. L.D.Clements.
Electronics, Vol. 33, No. 8, 52-4 (Feb. 19, 1960).

An arrangement of semiconductor devices to replace electromechanical equipment for voltage regulation, battery charge limitation and disconnection to prevent discharge at low engine speeds is described. It consists of three transistors, one rectifier and one reference Zener diode and several resistors, of which two are preset potentiometers. The operation of the circuit is described in detail, and curves plotting load voltage v. generator speed and v. current show the achievable performance compared with conventional regulator cut-out. To prevent change of characteristics with temperature, the following steps are taken: silicon transistors and diode are used; optimal temperature coefficient for the Zener diode is chosen, and fitting of thermistors in bias circuits is considered. A.Landman

621.316.722

2753 A QUANTITATIVE APPRAISAL OF VOLTAGE QUALITY. N.K.Arkhipov.
Elektrichestvo, 1959, No. 12, 26-7 (Dec.). In Russian.

The common method of appraising voltage quality according to maximum deviation from the rated value is insufficiently precise. Deviation is associated with values which in the theory of probability are termed fortuitous, and the average quadratic deviation or its square could serve as a measure of voltage quality. These values have been studied theoretically in detail and their use is warranted. Central Electricity Generating Board Digest

621.316.722

2754 CONTROL SYSTEM FOR THE DRIVE OF A CONTINUOUS HIGH-SPEED COLD-ROLLING MILL. B.N.Dralyuk.
Elektrichestvo, 1959, No. 12, 35-9 (Dec.). In Russian.

A decisive influence on the quality of the operation of the drive for a rolling-mill stand is exerted by the system of control for the generator voltage, which ensures agreement between the generator voltages for all the stands. Results of an investigation into this generator voltage-control system are given, the system being examined in static and dynamic conditions. The future development of the generator voltage-control system is discussed: the system with rotary amplifiers will not be used, magnetic amplifiers being preferable. Further advantages are offered by the control system using a thermionic exciter, which is considered to be the most expedient. Details are given.

621.316.722

2755 DESIGN AND EXPERIMENTAL TESTING OF VARIABLE IMPEDANCE ALTERNATING-CURRENT STABILIZERS. F.Perrier and J.M.Codina.
J. Phys. Radium, Vol. 18, Suppl. No. 12, 137A-143A (Dec., 1957). In French.

621.316.722

2756 A.C. VOLTAGE REGULATOR WITH MAGNETIC REACTOR AND DIODE CONTROL. E.Flötenmeyer.
Radio Mentor, Vol. 25, No. 8, 610-11 (Aug., 1959). In German.

The saturable reactor is controlled by a resistance bridge, one arm of which is formed by the anode to cathode impedance of a diode. The diode filament is supplied from the output voltage. Regulation of 0.1% is achieved over −20% to +15% variation of input voltage. Regulation times are of the order of 100 to 200 ms. The specially developed diode includes a shorting device operating when the filament burns out. A.Szaniecki

621.316.722.1

2757 ELECTRONIC VOLTAGE STABILIZERS WITH LOW INTERNAL RESISTANCE AND LOW NOISE. G.Giachino.
Alta Frequenza, Vol. 28, No. 1, 37-56 (Feb., 1959). In Italian.

Following a discussion of the design factors for series valve stabilizers with a two-stage amplifier, a design is worked out for an output of 150 V at 200 mA (in the detailed circuit the outputs from the first stage are transposed). Factors influencing output impedance are studied and methods of measurement are described. An analysis of departures from calculated values led to several minor modifications. Final values of Zo were about 0.02Ω, rising to 0.2-0.3Ω at about 100 kc/s. The change in output for mains voltage changes of ±10% was ±0.01 V. The drift in a 10 min. warm-up period was 70 mV; after 1 hr the drift was of the order of 40 mV over several hours. The r.m.s. noise voltage in the band 10 c/s to 10 Mc/s was 5-10 μV. Stepped graphs are given for the values of anode and cathode loads of both stages for output voltages from 100 V to 600 V. W.G.Stripp

621.316.722.1

2758 THYRATRON-STABILISED D.C. SUPPLIES. Mullard tech. Commun., Vol. 5, 34-47 (Feb., 1960).

Thyratrons can be used as combined rectifier and series-regulator valves in d.c. power supplied with ratings of up to 500 V d.c. at 70 A. For any current above 0.5 A this arrangement has advantages of efficiency, size, expense, etc. over hard-valve circuits, at the price of rather more elaborate smoothing. Details and performance figures of two half-wave units are given. One is a simple basic design. The other is a more complex design with an amplifier in the feedback loop, giving regulation better than ±1%.

621.316.726 : 621.373.421.1

2759 ELECTRIC METHODS FOR FREQUENCY CONTROL OF A STABLE RC OSCILLATOR. V.P.Demeshin.
Avtomat. i Telemekh., Vol. 19, No. 7, 695-707 (1958). In Russian. English summary: PB 141096T-6, obtainable from Office of Technical Services, U.S.Dept. of Commerce, Washington, D.C., U.S.A.

A new method is described which enables frequency to be regulated over a wide range. The dependence of frequency on control voltage and on transient processes is analysed, inertial and inertialess nonlinearity being taken into consideration. Circuits of the oscillators in question are given.

621.316.726 : 621.385.623.5

2760 FREQUENCY STABILIZATION OF A REFLEX KLYSTRON OSCILLATOR. F.Bruin and D.van Ladesteyn.
Physica, Vol. 25, No. 1, 1-8 (Jan., 1959).

A description is given of a servo, stabilizing the frequency of a microwave oscillator to the resonance frequence of a cavity, modulated at an audio frequency. The stabilizer requires no re-adjustment and is designed especially for very short waves and continuous operation.

621.316.726 : 621.313.3-8

2761 VARIABLE-SPEED CONSTANT-FREQUENCY DEVICES: A SURVEY OF THE METHODS IN USE AND PROPOSED. T.B.Owen.
Trans Amer. Inst. Elect. Engrs II, Vol. 78, 321-6 (1959) = Applic. and Industr., No. 45 (Nov., 1959).

The various methods are described in general terms and classified according to their action and arrangement of components; various combinations of mechanical, hydro-mechanical and electrical systems are included. A method of analysis follows in which the relationships between input, output and differential torques, powers and speeds are established and from which expressions for the efficiencies are derived. No numerical comparisons are made between the various systems and the question of excitation is mentioned only superficially. A short discussion is included. J.T.Hayden

621.316.727 : 621.316.13

2762 EFFECT OF METHODS OF COMPENSATION OF REACTIVE POWER ON STATIC LOAD STABILITY. S.A.Motýgina.
Elektrichestvo, 1959, No. 11, 27-31 (Nov.). In Russian.

Analysis has shown that compensation of reactive power by

means of static capacitors has a substantial influence on the static load stability. An approximate evaluation is made of the influence of the means of compensation on the stability of induction motors, and some results are given from experimental work on the study of static load stability. Metropolitan-Vickers

621.316.727

2763 ANALYSIS OF THE POWER FACTOR OF SERIES CIRCUITS WITH VARIABLE PARAMETERS.
D.N.Nestorescu.
Stud. Cercetari Energetica, Vol. 7, No. 4, 747-58 (1957). In Roumanian.

Three cases are considered: variation of capacitance; variation of inductance; and variation of both of these parameters. The study of this third case reduces to that of the second case. It is found that improvement of power factor depends on the choice of parameters of the system and the manner in which they vary, just as the variations of phase of the parameters vary with that of the applied e.m.f.

621.316.728 : 621.365.22

2764 LOAD CHARACTERISTICS OF A SUBMERGED-ARC SILICON-SMELTING FURNACE. G.Grant, III.
Trans Amer. Inst. Elect. Engrs II, Vol. 78, 273-6 (1959) = Applic. and Industr., No. 45 (Nov., 1959).

Describes the electrical performance of a 6 MUA furnace with particular reference to the effect of furnace operation on the supply system to which it is connected. Problems arise due to process difficulties causing severe voltage flicker and large swings in load demand. G.V.Hargreaves

PROTECTION

621.316.91

2765 THE PROTECTION OF LOW VOLTAGE INSTALLATIONS. N.Azzariti, G.Micchardi and N.Trizio.
Energia elett., Vol. 36, No. 10, 899-20 (Oct., 1959). In Italian.

For the protection of electrical apparatus against lethal voltages three methods of protection are commonly used: (a) connection of the metallic parts direct to earth; (b) connection to the neutral which in its turn is earthed: and (c) the use of earth-leakage circuit-breakers. Applications of the three methods are discussed and details given of Italian regulations. A mathematical analysis is made of the fault voltages which can appear on the apparatus for various methods of connection and results are presented of a comprehensive series of tests carried out on urban and rural networks. The article concludes with recommendations for installations to suit various site conditions. M.Rathbone

621.316.91

2766 DISTRIBUTION CIRCUIT PROTECTION. E.L.Guenzel and W.T.Morris.
Trans Amer. Inst. Elect. Engrs III, Vol. 78, 1064-71 (1959) = Pwr Apparatus Syst., No. 45 (Dec., 1959).

The distribution system in central Texas meets a peak load of approximately 800 MW, chiefly at a distribution voltage of 12.9 kV. Circuit protection is by auto-reclosing circuit-breakers for transient faults and fuses or "locking out" of circuit-breakers for permanent faults. Typical arrangements are described and operating data presented. It is concluded that the success of the scheme is attributable to the use of standardized items wherever possible; to careful site supervision in the case of line fuse installations; and to the use of universal methods in making additions and modifications to the gear. M.Rathbone

621.316.91 : 621.316.728

2767 UNDERFREQUENCY PROTECTION OF POWER SYSTEMS FOR SYSTEM RELIEF. LOAD SHEDDING-SYSTEM SPLITTING. C.F.Dalziel and E.W.Steinback.
Trans Amer. Inst. Elect. Engrs III, Vol. 78, 1227-38 (1959) = Pwr Apparatus Syst., No. 45 (Dec., 1959).

Practical suggestions are made for minimizing the interruption of service by load shedding. These are based upon a combined mathematical and graphical analysis which assumes the prime-mover governors and system voltage-regulators do not act during the period of time required for the system frequency to drop to the critical frequency and the necessary switching is completed before this frequency is reached. Presentation of basic ideas of load shedding is followed with application to the plant of a large steel mill in India. G.V.Hargreaves

621.316.925 : 621.313.323

2768 HIGH-SPEED RESTARTING AND PROTECTION OF LARGE SYNCHRONOUS MOTORS.
C.L.Phillips and M.H.Yuen.
Trans Amer. Inst. Elect. Engrs II, Vol. 78, 360-8 (1959) = Applic. and Industr., No. 45 (Nov., 1959).

The chemical process involved in a catalytic reformer unit depends on the drive to a compressor. The loss of this drive means loss of the catalyst as well as loss of production. A scheme is described in detail in which the compressor is driven by a synchronous motor which can be supplied from two separate sources of power. If one supply fails, the motor is automatically disconnected and restarted on the other supply. The principle feature is that the motor must be removed from the bus before a reclosure can re-energize it. This is done by a high-speed under-frequency relay. The operation of the scheme is fully described and all the necessary precautions are explained. A large number of oscillograms gives the results of tests. A bibliography and a discussion are added. R.G.Jakeman

621.316.925

2769 DISTRIBUTION PROTECTION AS USED ON THE PORTLAND GENERAL ELECTRIC COMPANY SYSTEM.
M.A.Bostwick.
Trans Amer. Inst. Elect. Engrs III, Vol. 78, 1081-6 (1959) = Pwr Apparatus Syst., No. 45 (Dec., 1959).

Circuit construction, the use of sectionalizing devices, protective-relay settings and the operating results attained in the protection of 4.15 and 12.5 kV open-wire circuits which supply an area where the load demand doubles every ten years are described. G.V.Hargreaves

621.316.925 : 621.314.223

2770 SPECIAL CIRCUITS FOR GROUND RELAY CURRENT POLARIZATION FROM AUTOTRANSFORMERS HAVING DELTA TERTIARY. P.A.Oakes.
Trans Amer. Inst. Elect. Engrs III, Vol. 78, 1191-6 (1959) = Pwr Apparatus Syst., No. 45 (Dec., 1959).

Three circuits are described by which polarizing current may be obtained for ground fault relays, which can be applied where the neutral current of earthed star windings is unsuitable, and which also avoid the use of current transformers inside the transformer delta winding. The circuits use only standard current transformer locations; selection of a circuit for given requirements is discussed. M.R.Dickson

621.316.925

2771 FAULT PRESSURE AND GAS DETECTOR RELAYS. H.A.Fohrhaltz.
Trans Amer. Inst. Elect. Engrs III, Vol. 78, 1416-24 (1959) = Pwr Apparatus Syst., No. 45 (Dec., 1959).

Describes the construction, and analyses the mechanical design, of a "fault pressure relay" which operates when the rate of pressure rise in the oil of a transformer exceeds a certain value. The influence of fault position and other factors on the speed of response was established by tests. A combination of oil-immersed fault-pressure relay and a gas (accumulation) detector relay is recommended for Atmoseal-type transformers. M.R.Dickson

621.316.925.4

2772 AN AUTOMATIC TRIP-AND-CARRIER TEST FOR PHASE-COMPARISON CARRIER-CURRENT RELAYS R.W.Hirtler.
Trans Amer. Inst. Elect. Engrs III, Vol. 78, 1072-5 (1959) = Pwr Apparatus Syst., No. 45 (Dec., 1959).

Describes a system which, every 4 hours, automatically makes a trip-and-carrier test on phase-comparison carrier-current relays. It is intended to duplicate, as nearly as is practical, the trip-and-block test recommended by the relay manufacturer. The equipment is designed for installation on transmission lines between unattended stations. During the trip portions of the test the relay is blocked for approximately 0.5 sec. However, if a fault should occur during this time, the protective relay will be restored to normal service in 10 cycles.

621.316.925.45

2773 SINGLE-SYSTEM REMOTE DEVICE FOR PROTECTION AGAINST MULTI-PHASE FAULTS.
G.F.Dolidze.
Elektrichestvo, 1959, No. 11, 60-4 (Nov.). In Russian.

By means of special measures it is possible to obtain a single-system remote device, reacting to all types of multi-phase faults at one point. The properties of such a device are investigated in various conditions. The analysis is carried out without taking either the load currents for the resistance of the arc at the place of the fault into account. Details are given of the characteristics necessary for correct operation of the device in all types of multi-phase faults.
Metropolitan-Vickers

621.316.933

2774 TESTS ON PROTECTIVE GAPS FOR DISTRIBUTION SERIES CAPACITORS. H.E.Weaver and N.M.Neagle.
Trans Amer. Inst. Elect. Engrs III, Vol. 78, 723-9 (1959) = Pwr Apparatus Syst., No. 44 (Oct., 1959).

Sparkover voltage, re-sealing voltage, and endurance tests on a 240 V gap for use with series capacitors of 2 to 7.5 kVAr rating are described. The conditions of the tests corresponded to those in practice for two types of series-capacitor application; (a) with a single distribution transformer; and (b) on a distribution feeder supplying several transformers. E.M.Dembinski

621.316.933.4 : 537.52

2775 SOME PROPERTIES OF A GRADED VACUUM SPARK GAP. J.W.Mather and A.H.Williams.
Rev. sci. Instrum., Vol. 31, No. 3, 297-304 (March, 1960).

A high power, low inductance vacuum spark gap combination (crowbar and main switch) is described which is capable of d.c. operation over a wide voltage range. The electrical properties are discussed in regard to shorting and multiple switch operation. The principal difficulty of vacuum spark gaps, the coating of the inner surface of the insulator with evaporated and sputtered electrode material, is absent in this design after conditioning. A mechanism to account for this, based on the establishment of a large number of nucleation centres on the insulating walls, is shown to be consistent with observation.

621.316.933.6

2776 SWITCHING SURGES ON VALVE ARRESTERS HAVING A REDUCED BREAKDOWN VOLTAGE. D.V.Shishman.
Elektrichestvo, 1959, No. 12, 64-9 (Dec). In Russian.

Consideration is given to surges with disconnection of inductance or capacitance; with closure to earth across an intermittent arc, and with resonant and other abnormal phenomena. 21 references.
Central Electricity Generating Board Digest

621.316.98 : 621.311.42

2777 THE PROTECTION OF OUTDOOR POWER STATIONS AGAINST LIGHTNING. B.Popa.
Energetica (Bucarest), Vol. 7, No. 5, 220-6 (May, 1959). In Rumanian.

621.316.98

2778 THE PARAMETERS OF LIGHTNING CURRENTS. ANALYSIS OF METHODS OF MEASUREMENT AND THE RESULTS OBTAINED BY THESE METHODS. G.Drăgan.
Energetica (Bucarest), Vol. 7, No. 7, 295-303 (July, 1959).
In Rumanian.

Results of measurements carried out by other investigators are tabulated and compared graphically. 34 references, mostly to C.I.G.R.E. papers.

621.316.98

2779 PROPAGATION OF OVERVOLTAGES AS A RESULT OF LIGHTNING STRIKE ON E.H.V. NETWORKS WITH PARTICULAR REFERENCE TO STATIONS HAVING CABLE CONNECTIONS.
Quad. Stud. Not., Vol. 16, 15-27 (Jan. 1, 1960). In Italian.

A mathematical analysis of the effect of changes in surge impedance on impulse wave fronts. The cumulative effects of reflection and refraction at the junctions of cable and overhead-line systems are calculated for different assumed wave shapes. A further analysis considers the effects on a system composed of an overhead line connected by cable to a main transformer; graphical results are presented for varying circuit conditions. M.Rathbone

621.316.99 : 621.316.57

2780 AUTOMATIC CIRCUIT BREAKERS FOR PROTECTION AGAINST LETHAL VOLTAGES. S.B.Toniolo.
Energia elett., Vol. 37, No. 1, 33-4 (Jan., 1960). In Italian.

Assuming a 380/220 V system with neutral earthed and a maximum safe voltage to earth of 65 V, for a 10 A circuit the conventional over-current device will not function for values of earth resistances in excess of 1.3 Ω. In cases where the nominal circuit rating is higher, the permissible earth resistances decrease. The use of earth-leakage circuit-breakers will however, permit much more sensitive protection with substantial earth resistances.
M.Rathbone

TRACTION . DRIVES

621.332.4

2781 THE INFLUENCE OF THE BREAKING OF A TRACTION SUPPLY RAIL ON THE DISPERSION OF CURRENT IN THE SOIL. G. Moisil.
Telecomunicatii, Vol. 3, No. 3, 110-19 (May-June, 1959).
In Roumanian.

621.335.2

2782 NEW POSSIBILITIES IN THE DEVELOPMENT OF ELECTRIC TRACTION WITH 50 c/s SINGLE-PHASE COMMUTATOR MOTORS. O.Benedikt.
Acta tech. Hungar., Vol. 26, No. 3-4, 229-71 (Dec., 1959). In German.

After describing and comparing several systems, a new scheme is described which has the object of compensating the transformer voltage over a very wide range of speed. In this scheme a 2 ph. squirrel-cage induction machine is connected in parallel with the exciting winding of the main motor. The theory is explained in detail. For improvements in starting, an auxiliary 25 c/s generator is used from rest and the 50 c/s supply is superimposed on this in steps, until the main motor is connected to the mains supply at speed. The questions of recuperative braking and p.f. improvement are considered at length. It is shown that the scheme has great advantages in operating characteristics and that a saving in weight and space is achieved. A bibliography is added. R.G.Jakeman

621.335.2

2783 MULTIPLE-UNIT OPERATION OF DIESEL AND ELECTRIC LOCOMOTIVES ON THE MILWAUKEE ROAD. L.Wylie.
Trans Amer. Inst. Elect. Engrs II, Vol. 78, 316-20 (1959) = Applic. and Industr., No. 45 (Nov., 1959).

A Diesel booster locomotive in combination with two electric locomotives is successfully used on a railway line traversing the continental watershed in the Rocky Mountains between the states of Idaho and Montana in the U.S.A. Before this could be put into operation it was necessary to reduce a train of 5800 t to one of 4800 t as the line contains gradients up to 2%. The details of the control gear of the Diesel locomotive are described and illustrated. The Diesel synchronizing controller may be connected to the main electric controllers by rack and pinion. The electric locomotives have a continuous rating of 5110 h.p. while the Diesel locomotive is rated at 1750 h.p. Speed–tractive effort characteristics are shown. The operation of the combined set is described. R.Neumann

621.335.2

2784 COMPARISON BETWEEN DIESEL AND ELECTRIC TRACTION ON THE DANISH STATE RAILWAYS.
J.L.Mansa.
World Power Conf., Canadian Sectional Meeting (Montreal, 7-11 September, 1958). Section I, Paper 103 I/3, 13 pp.

Between 1951 and 1956, the Danish Traction Committee compared the existing traction system on the main lines of the Danish State Railways, consisting mainly of steam locomotives, built between 1907 and 1950, supplemented by fast Diesel-electric railcars, with modern steam, modern Diesel and modern electric locomotives. The existing steam locomotives compared unfavourably with the modern, but the latter were found to be less economical than Diesel and electric motive power. The most interesting comparison was between Diesel-electric and electric locomotives in regard to their characteristics, and differences in weight, cost, energy consumption and speed. It was found that the operating costs and fixed charges

would be higher for the electric than for the Diesel motive power, both being considered on the basis of the 1951/52 traffic and on the basis of an intensified traffic. Since dieselization requires smaller investments and gives a more immediate return than electrification, the Danish State Railways have decided to continue it. The report contains a map of the Danish railway system and tables of data on the length of routes, volume of traffic, and capital and operating costs, as well as a graph of hauling characteristics.

E.W.Golding

621.316.91 : 621.314.2

NOTES ON TRANSFORMER OPERATION. See Abstr. 2686

621.335.42 : 621.311.6

2785 A HIGH-CAPACITY MAINTENANCE-FREE GENERATING SYSTEM FOR MOTOR COACHES. R.L.Larson.
Trans Amer. Inst. Elect. Engrs II, Vol. 78, 311-16 (1959) = Applic. and Industr., No. 45 (Nov., 1959).

The target specification for the system to replace the conventional 120 A d.c. generator and double voltage-and-current regulators of the vibrating-contact type is given, the main requirements being to obtain 1 million miles of maintenance-free operation, a rating of 200 A with 125 A available at engine idling speed and the ability to retain the voltage setting unchanged over a period of years. The generator is a 3-phase 12-pole Lundell-type machine with built-in silicon rectifiers and is oil cooled. The regulator merely controls the voltage since the generator is inherently current limited and the rectifiers prevent the flow of reverse current; it is transistorized and employs printed-circuit techniques. Details of construction and performance of the generator (including insulation) and regulator are given and it is claimed that 3 years operation indicates that the approach is basically sound. J.T.Hayden

621.34

2786 ELECTRICAL CONTROLS IN THE STEEL INDUSTRY. II. J.C.Christie and J.T.Jones.
Elect. Rev., Vol. 165, No. 18, 823-9 (Dec. 11, 1959).

For Pt I, see Abstr. 709 (1960). A description of the control problems in single-stand and tandem cold-strip mills is given together with an account of the typical features included in the control of process lines. Some general observations of control principles and future developments are made. Specimen control circuits for all types of drive, are given. M.Rathbone

621.34

2787 PULP TO PAPER.
Elect. Times, Vol. 137, 41-7 (Jan. 14, 1960).

The paper-making process is described from the grinding of the logs to the finished product. A detailed description is given for the plant at Bowater's extensions for the Mersey division of the organization. The two newsprint machines can produce paper up to 2000 ft./min. and the two high-speed winders operate up to nearly 70 m.p.h. The log-grinding installation is automatically controlled to maintain a predetermined load of up to 16000 h.p. from synchronous motors. Several diagrams and illustrations of the plant are included. R.G.Jakeman

621.34

2788 D.C. ELECTRIC DRILLING RIGS: APPLICATION AND OPERATION. E.E.Hogwood, Jr.
Trans Amer. Inst. Elect. Engrs II, Vol. 78, 286-91 (1959) = Applic. and Industr., No. 45 (Nov., 1959).

The application of electric equipment to drilling-rig drives can be made more economical if close consideration of the engine, load and equipment is made. The generator should match the engine as closely as possible. The motors should be selected on the basis of the load so that their intermittent capacity can be used. The characteristics of the plant are discussed as regards the draw-works, mud pumps and rotary table. It is preferred that the control of the generator should be by static devices, such as saturable reactors and magnetic amplifiers, rather than inherent regulation by means of the 3-field system. A discussion is added. R.G.Jakeman

CONDUCTORS . RESISTORS

(See also Semiconductor Materials)

621.315.5 : 621.374.32

MEASURING CRITICAL CURRENT IN CRYOGENIC CIRCUITS. See Abstr. 2304

621.315.534

2789 HIGH-STRENGTH ALUMINIUM-ALLOY CONDUCTORS. E.W.Greenfield.
Trans Amer. Inst. Elect. Engrs III, Vol. 78, 1449-55 (1959) = Pwr Apparatus Syst., No. 45 (Dec., 1959).

Deals with a conductor (known as A.A.A.C.) consisting of high-strength heat-treated aluminium alloy. The development of the conductor is described and its properties and characteristics are compared with various other types of conductor, particularly steel-reinforced. The minimum average properties of A.A.A.C. are given as: (1) wire sizes of 0.1317 in. and smaller, 48000 lb/in.^{2} tensile, a conductivity of 53% I.A.C.S. (International Annealed Copper Standard); (2) wire sizes of 0.1318 in. and larger, 46000 lb/in.^{2} tensile, 52% I.A.C.S. H.A.Miller

INSULATING MATERIALS
DIELECTRICS

621.315.615 : 621.215.2

2790 PHYSICAL PROPERTIES OF NON-DRAINING COMPOUNDS. K.E.Büscher.
F. und G. Rdsch., No. 44, 156-65 (July, 1959). In German.

Several commercial non-draining compounds have been examined by measuring viscosity, flowpoint, specific volume, expansion coefficient and absorption coefficient between 20° and 140° C. The results were compared with standard impregnating oils used in solid paper-insulated heavy-current and high-pressure cables. Wide differences between compounds are noted and discussed. Care must be exercised in choosing a particular compound for a particular application. The high quality of the non-draining compounds is maintained by increased control and testing of the raw materials and the non-draining mixtures. See also Abstr. 2109 (1960). W.A.Walker

621.315.616 : 621.313.12

HIGH QUALITY INSULATION FOR LARGE GENERATORS. See Abstr. 2662

621.315.616 : 621.34

DOUBLY INSULATED ELECTRIC HAND-DRILLS. See Abstr. 2100

621.315.616.96

2791 STUDY OF THE CORRELATION OF SOME EXPERIMENTAL PARAMETERS OF INSULATING SYNTHETIC RESINS. C.Benco and F.Vacchi.
Energia elett., Vol. 36, No. 12, 1122-33 (Dec., 1959). In Italian.

A series of photomicrographs of sections through copper wire toroids impregnated with the resins illustrates the effectiveness of penetration and bonding for different compositions (polyurethane, phenolic, silicone, and epoxy) and methods of impregnation and for different wire coverings. Measurements are given of the dielectric loss angle at mains frequency as a function of temperature and voltage for several of the treatments. Finally the thermal conductivities of specified test pieces are given as measured by the method described. F.F.Roberts

621.315.619

2792 ACCELERATED AGING CHARACTERISTICS OF FORMEX- AND PAPER-INSULATED WIRES IN TRANSFORMER OIL.
M.F.Beavers, H.H.Brustle, J.H.Carpenter and W.J.Degnan.
Trans Amer. Inst. Elect. Engrs III, Vol. 78, 1202-7 (1959) = Pwr Apparatus Syst., No. 45 (Dec., 1959).

Techniques and test procedures are described for accelerated ageing tests in round and rectangular section conductors, insulated with manilla paper or with Formex (polyvinyl formal). Tests were carried out in oxygen- and water-free transformer oil, in small

hermetically sealed steel containers, at normally unknown pressures of several atmospheres, and at temperatures of 125, 150 and 175°C. Ageing was judged by tests of dielectric strength measured between two straight specimens clamped together, and for the Formex insulation by bending tests and impression tests. Extrapolation of the results to 150°C shows that for paper at this temperature the dielectric strength will fall to half value in about 17 years. The life for Formex using the same ageing criterion is many times this figure, and the results indicate that this material may safely be operated at least 10°C higher than paper. M.R.Dickson

MEASURING METHODS
ELECTRICAL TESTING

621.317.32 : 621.314.222

2793 A FUNDAMENTAL DETERMINATION OF THE ERRORS OF VOLTAGE TRANSFORMERS FOR VERY HIGH VOLTAGES BY A SUMMING METHOD USING CAPACITIVE DIVIDERS. E.Zinn.
Elektrotech. Z. (E.T.Z.) A, Vol. 80, No. 19, 659-65 (Oct. 1, 1959). In German.

A method previously described employed ring-type auxiliary transformers and was usable up to $120/\sqrt{3}$ kV (see Abstr. 1341 of 1959). The present method substitutes a h.v. capacitive divider for the auxiliary transformers. The divider consists of a h.v. compressed-gas capacitor (~ 50 pF), and a mica capacitor (~ 6.4 μF). A second divider with similar values of capacitance, but including a 40 kΩ adjustable resistor, is connected in parallel with the main divider and functions as a Wagner earth. The apparatus is usable up to $400/\sqrt{3}$ kV. Details are given of tests (up to $120/\sqrt{3}$ kV) using both methods, and the results compared. C.F.Pizzey

621.317.32 : 621.313.12

2794 ON A PARTICULAR METHOD FOR THE DETERMINATION OF POTENTIAL FIELDS. M.Kotal.
Elektrotech. Obzor, Vol. 49, No. 1, 30-6 (1960). In Czech.

Explains and derives basic relations of Southwell's relaxation method for the investigation of potential fields. Describes a procedure for the solution of the field, when a singularity occurs. Illustrates the method by determining the field in front of the stator of a generator. N.Klein

621.317.32 : 621.315.611

2795 RECOVERY VOLTAGE IN ELECTROMETRIC MEASUREMENTS OF VERY HIGH RESISTANCES OF ABNORMAL SOLID DIELECTRICS. W.Kavka.
Prace. P.I.T., No. 24, 23-35 (1958). In Polish.

It is shown that correct results depend on applying the appropriate method and on initial conditions of measurement. The criteria for evaluation of initial polarization and maximum time limit for it are given. Transient states of an abnormal dielectric are discussed in connection with the nonstationary method of electrometric measurement. The experimental results are quoted and the choice of a suitable method of measurement is indicated. M.W.Makowski

621.317.32

2796 AN EQUIPMENT FOR THE MEASUREMENT OF ALTERNATING VOLTAGES AND THE CALIBRATION OF A.C. VOLTMETERS. H.Aster.
Slaboproudy Obzor, Vol. 21, No. 1, 29-33 (1960). In Czech.

The equipment consists of five units: (1) a peak voltmeter having a range of 1 to 300 V with an error of 0.08% at frequencies up to 1 kc/s, and an error of 0.5% at frequencies up to 10 kc/s, the measured voltage being compared oscillographically with that of a Weston cell; (2) a diode voltmeter, for the voltages from 1 to 100 V which is used to compare two voltages in the frequency range from 500 c/s to 200 Mc/s; (3) a symmetrical RC oscillator for frequencies from 20 c/s to 60 kc/s; (4) an LC oscillator for frequencies from 50 kc/s to 55 Mc/s; (5) an LC oscillator for the range 70 to 200 Mc/s. The two voltmeters are complementary in that the peak voltmeter permits accurate calibration, while the diode voltmeter is used to measure the frequency response of the instrument under test. Circuit diagrams of the equipment are given. R.S.Sidorowicz

621.317.33 : 537.7

2797 MEASUREMENT OF THE RESISTIVITY CONSTANTS OF ANISOTROPIC CONDUCTORS BY MEANS OF PLANE-PARALLEL DISCS OF ARBITRARY SHAPE.
J.Hornstra and L.J. van der Pauw.
J. Electronics and Control, Vol. 7, No. 2, 169-71 (Aug., 1959).

It has been shown previously [Abstr. 1039 A of 1958, Philips Res. Rev., Vol. 13, No. 1, 1-9 (Feb., 1958)] that the resistivity of an isotropic conductor can be determined from measurements of the resistances between four small contacts at arbitrary positions along the circumference of a plane-parallel sample of arbitrary shape. It is now shown that the expression previously given for isotropic conductors is also applicable to anisotropic conductors if the resistivity constant ρ in that expression is interpreted as the geometric mean of ρ_2 and ρ_3, i.e. $\rho = \sqrt{(\rho_2 \rho_3)}$, where ρ_1, ρ_2 and ρ_3 are the resistivity constants along the three orthogonal axes. Similarly, by using samples with the axes in the appropriate directions, the quantities $\sqrt{(\rho_3 \rho_1)}$ and $\sqrt{(\rho_1 \rho_2)}$ can be determined. C.F.Pizzey

621.317.331

2798 CALIBRATION OF HIGH RESISTANCE PADDED RESISTORS. R.P.Sykes.
Instrum. Control Syst., Vol. 32, No. 10, 1536-8 (Oct., 1959).

The requirement to check that high-precision resistors used in some analogue computers maintain their value accurately with age has lead to the development of a method to determine their value. The test circuit comprizes a standard oven-controlled resistor in the feedback of a d.c. amplifier, and the "unknown" resistor is connected as the input resistor. By means of a decade resistance shunting the feedback, the amplifier gain is adjusted to unity. The input and output signals are summed in a specially designed d.c. amplifier which detects the resulting null. If the unknown value differs from that specified, a suitable padding resistor is added where possible. Practical details of the equipment and organizational procedure are discussed. K.C.Garner

621.317.333 : 621.314.2

DISTORTION OF THE VOLTAGE WAVE-FORM OF TESTING TRANSFORMERS RESULTING FROM HARMONICS IN THE MAGNETIZING CURRENT. See Abstr. 2684

621.317.333.4

2799 FAULT LOCATION OF SHORT-CIRCUITED CABLES IN TOWNS. G.Boldea.
Telecomunicatii, Vol. 3, No. 5, 197-203 (Sept.-Oct., 1959). In Roumanian.

For Pt I, see Abstr. 5818 (1959).

621.317.333.8 : 621.315.1

2800 IMPULSE MEASUREMENTS ON TRANSMISSION LINES. A.P.Osadchii.
Elektrichestvo, 1959, No. 11, 65-70 (Nov.). In Russian.

Impulse devices for determining the distance to the point of a fault on a transmission line are widely used in the U.S.S.R., but little attention has been paid to the problem of impulse measurements on overhead lines. Phenomena occurring in a multi-conductor system are examined and results of calculations and some experimental data are given. Paragraphs are devoted to the propagation of impulses along a line, experimental work, and measurements in complex networks. Metropolitan-Vickers

621.317.333.8

2801 INVESTIGATION OF DISCHARGE PHENOMENA AT HIGH VOLTAGES. J.Koenig.
Elektrie, Vol. 13, No. 9, 327-32 (Sept., 1959). In German.

In connection with the design of a 2.25 MV test transformer a test method was developed to determine the onset of internal discharges in a dielectric. The coupling between the high-voltage source and the test object and the oscillographic measuring device, tuned to a frequency of from 1.5 to 2 Mc/s, are described in detail. The effect of internal discharges on different types of insulating material is discussed. If the onset voltage after application of the test voltage differs from that measured before application of the test voltage permanent damage must be assumed to have been sustained by the test object. After preliminary exploratory work an improved capacitor bushing was developed and the successful application of the test method to the complete test transformer is described. R.H.Golde

621.317.333.8 : 621.313.3

2802 ELECTRONIC SURGE TESTING OF UNIVERSAL ARMATURES WITH NULL DETECTION. H.R.Weed.
Trans Amer. Inst. Elect. Engrs III, Vol. 78, 1219-26 (1959) = Pwr Apparatus Syst., No. 45 (Dec., 1959).

Two alternative methods of carrying out surge-comparison testing in the production lines of small d.c. and universal armatures and field coils are proposed in order to make the tests more sensitive. With both methods, two simultaneous pulses are produced : one is applied to the coil under test and the other to a standard coil. The resulting transients are observed by alternative techniques, both resulting in null detection. The first employs a conventional bridge circuit and the second Lissajous figures. A circuit diagram and a detailed description of the surge circuit and its various modes of operation are given. The unit comprises basically two identical capacitors charged to a continuously metered value of voltage and which are connected to the external circuit by means of two hydrogen thyratrons; these are so arranged that the discharges are simultaneous to within 0.05 μsec. A simple analysis is carried out to indicate the trends of the waveshape under certain types of fault and to correlate them with some of the test waveshapes in the paper.
J.T.Hayden

621.317.333.82

2803 DETERMINATION OF THE 50 PER CENT IMPULSE DISCHARGE VOLTAGE. B.M.Ryabov.
Elektrichestvo, 1959, No. 9, 84-8 (Sept.) In Russian.

Calculations are presented giving the number of pulses necessary for determining, to a given accuracy, the 50% impulse voltage, i.e., the voltage amplitude for which the discharge probability in the sample is 50%.
Z.Krasucki

621.317.335

2804 THE EFFECT OF THE IMPEDANCE OF THE ELECTRODES IN DIELECTRIC LOSS MEASUREMENTS. F.Deutsch.
Bull. Assoc. Suisse Elect., Vol. 50, No. 25, 1226-31 (Dec. 5, 1959). In German.

In certain cases, e.g. in testing the insulation between transformer windings, the dielectric cannot be provided with perfectly conducting electrodes. In the example given, the transformer windings represent distributed resistance and inductance in series. The resulting errors in capacitance and loss angle, as measured with a Schering bridge, are calculated.
K.W.Plessner

621.317.335.2

2805 CAPACITOR CALIBRATION BY STEP-UP METHODS. T.L.Zapf.
J. Res. Nat. Bur. Stand., Vol. 64C, No. 1, 75-9 (Jan.-March, 1960).

Step-calibration methods are used in many physical laboratories for the extension of measurements to quantities far removed from the magnitude of greatest accuracy at which absolute determinations are made. The excellent precision of repetitive substitution procedures is exploited by step-up or step-down methods to extend measurements to higher or lower magnitudes without serious degradation of accuracy. The application of step-up techniques to the calibration of variable air capacitors is described as a practical example of the method.

621.317.34

2806 FIELD-STRENGTH MEASUREMENTS IN HIGH-FREQUENCY FIELDS. II. H.Fricke.
Arch. tech. Messen, No. 280. (Ref. V 313-2) 89-92 (May); No. 282 (Ref. V 313-3) 133-6 (July, 1959). In German.

Experimental procedures and apparatus used in field-strength measurements are described further (See Abstr. 5565 of 1959). Frame aerials are used for frequencies up to 100 Mc/s. The limit is set by the distributed self-capacities of the frame making it resonant. This resonant point must lie outside the third harmonic of the measuring frequency and the frame dimensions must not exceed λ/12. Use of grounded vertical aerials, half-wave dipoles and unipoles for the measurement of field intensity is considered in some detail. Conventional valve voltmeters are used for large field-strengths between 0.01 and 1 V/m. Other methods employ receivers with a calibrated attenuator at intermediate frequency or the substitution method in which the field from a distant transmitter is compared with that of a standard generator. The influence of the earth's surface, and its nature, on the results of the measurements, is examined. Special cases include measuring techniques of pulse-modulated signals and interference fields.
Z.F.Voyner

621.317.34

2807 TANGENT METHOD ANALYSIS FOR HIGH-INSERTION-V.S.W.R. LOSSLESS TWO-PORTS. H.M.Altschuler.
Proc. Inst. Radio Engrs, Vol. 47, No. 11, 2022 (Nov., 1959).

A new method of measuring high v.s.w.r. is discussed and illustrated by experimental results.
A.E.Karbowiak

621.317.34 : 621.372.5

2808 I.R.E. STANDARDS ON METHODS OF MEASURING NOISE IN LINEAR TWOPORTS, 1959.
Proc. Inst. Radio Engrs, Vol. 48, No. 1, 60-8 (Jan., 1960).

621.317.34 : 621.385.632.1

2809 MEASUREMENT OF INTERNAL REFLECTIONS IN TRAVELING-WAVE TUBES USING A MILLIMICRO-SECOND PULSE RADAR. D.O.Melroy and H.T.Closson.
Proc. Inst. Radio Engrs, Vol. 48, No. 2, 165-8 (Feb., 1960).

Describes a test method which enables one to locate reflections on travelling-wave tube helices and to measure the return loss of each reflection. This information is needed for travelling-wave tubes used in pulse code transmission since "echo" pulses arising from reflections can distort the meaning of the code. This test method employs millimicrosecond pulses in a radar circuit with a stroboscopic viewing system. The sensitivity of the system permits easy observation of reflections having return losses as high as 40 dB. Two previously unsuspected sources of helix reflections have been identified using this method.

621.317.37 : 621.313.32

2810 MEASUREMENT OF LOAD ANGLE UNDER STEADY STATE AND OSCILLATORY CONDITIONS FOR A SYNCHRONOUS MACHINE. R.E.Steven.
Bull. elect. Engng Educ., No. 23, 26-32 (Dec., 1959).

Various methods have been developed for the measurement of load angle for synchronous machines. These have been classified under the headings: (a) stroboscopic devices; (b) vector synthesis; and (c) angular position devices. Each of these methods is open to criticism either on the grounds of unlimited accuracy of measurement or because of the complication involved due to the need for specialized and elaborate equipment. Further limitations are imposed when records are required for the examination of transient stability. The method described affords a high accuracy of measurement and employs relatively simple or standard-pattern test equipment. The instantaneous angular position of the rotor is determined by a photo-electric method. Load angle can be measured to an accuracy of about ±0.1° and inherently to a higher accuracy if required. For oscillatory conditions successive amplitudes can be read directly, but generally a permanent record of the oscillation is preferred. It is shown that the standard camera attachment for the c.r.o. will provide this record.

621.317.373

2811 A METHOD OF MEASURING THE PHASE SHIFT OF TWO VOLTAGES. V.V.Kovalevskaya and V.C.Popov.
Priborostroenie, 1959, No. 2 (Feb.). In Russian. English translation in: Instrum. Constr., 1959, No. 2, 17-20 (Feb.).

The measurement is based on the sum and difference method after the voltages are accurately stabilized. Nonlinear resistors (i.e. thermistors) are employed in the amplifier for stabilizing. The circuit is shown, and a comprehensive error analysis is given. Normally, phase shifts between 0° and 120° are accomodated. The sign of the phase shift is also determined.
K.C.Garner

621.317.373

2812 THE MEASUREMENT OF PHASE DELAY OF VIDEO AMPLIFIERS AND NETWORKS. J.Wobst.
Tech. Mitt. BRF, Vol. 2, No. 2, 37-40 (May, 1958). In German.

After a brief discussion of the physical meaning of phase angle, phase delay and group delay, the overwhelming use of the latter only for the evaluation of wideband amplifier transient response is criticized, and a plea is made for the change to direct phase-delay measurement. Two methods are described, that by Yu (Abstr. 1388 of 1956) and that by Schönfelder (Abstr. 2781 of 1957), and then the author's novel and very accurate method. It consists of direct measurement of time by means of a special oscilloscope of the "synchroscope" type with single-stroke scan facilities and with a calibrated time magnifier. The input- and output-signals are switched by a low-capacitance difference-relay driven at 50 c/s The apparatus and measurement routine are described; the latter is most conveniently undertaken with a television line-sync. pulse

for the locking of the single-stroke scan. Typical tests are illustrated by several oscillograms indicating an obtainable accuracy of 4 milliμsec. A.Landman

621.317.39 : 621.389

2813 RECORDING MANOMETER.
W.E.Gilson and H.Ludwig.
Electronics, Vol. 32, No. 52, 41 (Dec. 25, 1959).

A photocell is mounted on a vertical slide with a cylindrical lens focusing on the manometer column. As the column moves a servo system drives the cell up or down and it centres always at the meniscus. The height is converted to a voltage which operates a recorder. F.T.Farmer

621.317.39

2814 THE ELECTRO-MECHANICAL BALANCE IN PRESSURE AND TEMPERATURE MEASUREMENT.
D.A.Bristol and E.S.Gilchrist.
A.I.E.E. Analog and Digital Instrumentation Conference Paper, p. 202-11. See Abstr. 3875 (1959).

A force-measuring device of the type in which the position of a moving coil is held nearly constant by feeding back to it current from an amplifier is used as the basis of a process-control measuring device. For pressure, for example, the force is generated by the action of the pressure on a pair of diaphragms and an output of 1 to 5 ma is given for pressure ranges from 0 to 50 in. of water to 0 to 80 psi. Accuracy is ±0.5% of span. The same device can be used as a d.c. amplifier and with a thermocouple input gives a zero accuracy of 1.5°F. G.A.Montgomerie

621.317.39 : 534.23

2815 PIEZOELECTRIC TRANSDUCERS.
A.C.Dobelli.
Acustica, Vol. 6, No. 4, 346-56 (1956).

A brief review is presented of the properties and parameters of the most widely used piezoelectric materials, some of which are given in terms of equivalent circuits; next some of the considerations that should be given to the choice of materials and dimensioning of the element for particular applications. A few piezoelectric crystals are characterised which, although not used on a commercial scale, are nevertheless of scientific interest. Some references are given to some recent developments in the field of piezoelectric polycrystalline ceramics.

621.317.39 : 534.23

2816 MEASUREMENTS ON ELECTROMECHANICAL TRANSDUCERS. H.G.Diestel.
Acustica, Vol. 6, No. 4, 357-60 (1956). In German.

An apparatus for the continuous recording of the frequency curves of electromechanical transducers is described, in which the back-coupling on to the driving system is compensated by a control circuit. The frequency curves of a piezoelectric and an electrodynamic detector for vibrations of solids are given as examples. In a gyratory "one' way-system" the relevance of the reciprocity principle is experimentally exemplified.

621.317.39 : 621.395.6

2817 DETERMINING SONAR SYSTEM CAPABILITY.
G.Rand.
Electronics, Vol. 33, No. 8, 41-5 (Feb. 19); No. 9, 62-5 (Feb. 26, 1960).

Contains a summary of basic data of interest in the design of underwater echo-location systems. The second part deals with the characteristics of electromechanical transducers used for this purpose. V.G.Welsby

621.317.39 : 534.15

2818 LONGITUDINAL VIBRATION MEASUREMENTS IN THE MEGACYCLE RANGE MADE BY ELECTROSTATIC DRIVE AND FREQUENCY-MODULATION DETECTION.
P.G.Bordoni and M.Nuovo.
Acustica, Vol. 7, No. 1, 1-7 (1957).

The frequency range of the equipment described is about 20 times wider than that of all previous apparatus. Details are given of the frequency-modulation and detection circuits used, together with typical data on their sensitivity and signal-to-noise ratio. The behaviour of the apparatus is checked in a practical case, for measuring the frequencies of the first eleven longitudinal modes, for an aluminium plate, in the range from 0.5 to 5.5. Mc/s.

621.317.39

2819 SYSTEMATIC SURVEY OF ANGULAR OR LINEAR DISPLACEMENT DIGITIZERS. A.D.Talantsev.
Avtomat. i Telemekh., Vol. 20, No. 3, 361-75 (1959). In Russian.

Discusses many of the techniques used for converting analogue information representing mechanical motion, rotation or displacement into digital form. Digitizers are classified by (1) quantization method and (2) coding method. Various methods to prevent incorrect reading are discussed. 43 refs.

621.317.39 : 621-52 : 621.382.3

2820 AUTOMATIC MEASUREMENT OF THICKNESS AS APPLIED TO GERMANIUM WAFER PRODUCTION IN TRANSISTOR MANUFACTURE. C.E.Bicknell.
Proc. Instn Elect. Engrs, Paper 3046 E [International Convention on Transistors and Associated Semiconductor Devices], Vol. 106B, Suppl. 17, 1171-5, 1181 (1959).

The paper first examines the problems involved in the measurement of the thickness of germanium wafers, the difficulties encountered in handling and manoeuvring them due to their small size and weight and the nature of their material composition. Errors and failings in hand measurement are discussed, together with the advantages of mechanical measurement. The design and construction of an automatic measuring machine are then described, showing how the wafers are measured, sorted into seven different sizes and counted. The movement of them to the measuring point is by mechanical means, but they are measured, sorted and counted electronically. Measurement is effected by an electronic comparator of high magnification and accuracy, the output signal of which is amplified and then used to operate the sorting mechanism. Some half-million wafers were measured during the development period, which is described, together with the difficulties encountered and the modifications found necessary finally to produce the consistency and accuracy of measurement required. In conclusion, the assets of the machine in eliminating human error in hand measurement and operator fatigue, together with its production capacity, are described.

621.317.39 : 621.357.7

2821 DETERMINATION OF THE THICKNESS OF PLATING BY MEASURING THE THERMAL E.M.F. D.A.Goldring.
Priborostroenie, 1959, No. 1 (Jan.). In Russian. English translation in: Instrum. Constr., 1959, No. 1, 26-7 (Jan.).

Describes an instrument for the measurement of plating thickness based on the thermal e.m.f. developed when applying a heated probe to the plating surface. The circuit diagram and instrument are illustrated. 6 refs. W.A.Walker

621.317.39 : 531.71

2822 MICROWAVE THICKNESS DETECTOR.
J.B.Beyer, J.Van Bladel and H.A.Peterson.
Rev. sci. Instrum., Vol. 31, No. 3, 313-16 (March, 1960).

A device is described which is capable of continuously measuring the thickness of moving conducting materials. The details of two independent methods, one utilizing the amplitude and one the phase of reflected microwave energy, are explained and compared. Experimental results verify that increments of the order of 1/40 mm are clearly detectable.

621.317.39 : 531.78

2823 RECORDING WEIGHT METER.
D.J.Steele.
J. sci. Instrum., Vol. 37, No. 1, 27-30 (Jan., 1960).

Modifications to a commercial platform weighing machine, to provide a continuous record of changes in weight of a standing load on the platform, are described. With this instrument, weight changes of up to 55 lb in a maximum load of 560 lb can be recorded to an accuracy of 0.5%, i.e. less than 5 oz, which is the accuracy of the weighing machine itself. An earlier instrument, although satisfactory for short periods of operation, was found to be unsatisfactory for measuring weight changes over a time in excess of a few hours, owing to random changes of up to 2 lb in full-scale calibration of 50 lb. This difficulty has been overcome in the present instrument by using photoelectric cells to detect the vertical movement of the steelyard, and a servo-operated mechanism to control the restoring force. The output, which is directly proportional to the change in weight on the platform, is in a form which is suitable for being recorded on a potentiometric recorder. It is substantially independent of normal ambient temperature changes; the calibration changes by 0.01% per deg K change of ambient temperature. This error can be allowed for if the ambient temperature changes are known.

621.317.39 : 536.53

2824 DIRECT READING RESISTANCE THERMOMETER BRIDGE. I. T.M.Dauphinee and H.Preston-Thomas.
Rev. sci. Instrum., Vol. 31, No. 3, 253-7 (March, 1960).

Describes the basic circuitry required for a high precision direct reading resistance thermometer with dials calibrated in degrees C and any standard platinum resistance thermometer as sensing element. A circuit was developed which, through linear variations of the resistance elements, gives a quadratic law having the form $R = R_0(1 + AT + BT^2)$, where B is negative, as is required for a platinum thermometer. At the same time it allows separate adjustments for slope A and curvature B or B/A of the resistance v. temperature relation of the particular thermometer being used and also for the ice point resistance R_0. The auxiliary circuitry is given for comparing the computing circuit with the thermometer and for maintaining a constant recorder sensitivity of all temperatures; stability requirements for work to 0.001° C over a 700° C range are discussed.

621.317.39 : 536.53

2825 DIRECT READING RESISTANCE THERMOMETER BRIDGE. II.
T.M.Dauphinee, C.G.M.Kirby and H.Preston-Thomas.
Rev. sci. Instrum., Vol. 31, No. 3, 258-63 (March, 1960).

Presents the details of circuitry and construction for a direct reading resistance thermometer which was built utilizing the design criteria formulated in Pt I. By using any standard 25.5 Ω platinum resistance thermometer as a sensing element, the bridge gives subdivision of the temperature scale to 0.001° C between −50° and +700° C with an accuracy exclusive of that of the thermometer of about ± 0.001° C. Methods are described that allow for variations of thermometer constants, for autocalibration of the bridge circuit, and for maintaining constant sensitivity by variation of the thermometer current. The bridge as described has performed satisfactorily for three years and has proved to be a useful and convenient laboratory tool.

621.317.39 : 537.32

2826 DEVELOPMENT OF A SPECIAL THERMOCOUPLE FOR MEASURING TRANSIENT TEMPERATURES WITHIN A SOLID BODY. J.D.Clem, Jr.
Rev. sci. Instrum., Vol. 31, No. 3, 334-6 (March, 1960).

A special thermocouple was developed to measure transient temperatures at relatively large distances within the walls of uncooled rocket nozzles. The device, known as a thermoplug, was designed to cause a minimum disturbance of the temperature field. Results of l' nited experiments indicate the design to be adequate for the purpose for which it was developed. All development work was done using a homogeneous metallic nozzle, but the design could be adapted readily to nonmetallic or composite nozzle walls. The thermoplug may be fabricated in the laboratory and should be adaptable to many internal temperature measurements not connected with rocket propulsion units.

621.317.39

2827 MEASUREMENT OF AMBIENT-AIR TEMPERATURE DURING TEMPERATURE TEST ON TRANSFORMERS. M.F.Beavers.
Trans Amer. Inst. Elect. Engrs III, Vol. 78, 1021-9 (1959) = Pwr Apparatus Syst., No. 45, (Dec., 1959).

Describes work to determine the time constants of a number of lagged thermometers (using the term defined in BS 2725-1956) using tin cans and glass jars of various sizes, containing water or oil. Thermal tests are also reported using these thermometers in heat runs on transformers. M.R.Dickson

621.317.39 : 621.311.21

2828 COMPARISON OF FLOW-MEASURING TECHNIQUES AT KINLOCHLEVEN HYDRO-ELECTRIC STATION. F.A.L.Winternitz.
Water Pwr, Vol. 12, No. 3, 93-103 (March, 1960).

Describes field tests in which various methods of flow measurement were compared in a 40 in. pipeline. Advanced versions of the current-meter, pitot-tube, salt-velocity and salt-dilution techniques of gauging the flow were investigated and a comparison made of the systematic and random errors, the convenience of the various methods, and the man-hours required in each case.

621.317.39 : 531.76

2829 DETERMINATION OF THE SPEED OF PASSING VEHICLES BY APPARATUS USING [INTERRUPTED] LIGHT BEAMS. F.G.Altman and K.H.Busch.
Z. InstrumKde, Vol. 67, No. 12, 311-18 (Dec., 1959). In German.

Deals with two different types of instrument. The speed is determined by the time taken for the vehicle to travel a known distance. One of the instruments indicates the time on a ballistic galvonometer and the other presents a digital display on an electronic counter.

621.317.39 : 621.389

2830 INSTRUMENTATION FOR AUTOMATICALLY PRE-SCREENING CYTOLOGICAL SMEARS.
R.C.Bostrom, H.S.Sawyer and W.E.Tolles.
Proc. Inst. Radio Engrs, Vol. 47, No. 11, 1895-900 (Nov., 1959).

Mass-screening application of the cytological smear for the detection of cervical cancer has been limited by a lack of technicians to screen the smears. By using an instrument to identify automatically those smears which are clearly negative, the effectiveness of the technician could be greatly increased. A quantitative analysis of a large number of smears showed that positive smears usually had a small number of cells with abnormally large and intensely stained nuclei that did not appear on negative smears. On the basis of this analysis, an experimental instrument — called the Cytoanalyser — has been constructed. The Cytoanalyser scans a smear, measures the size and light absorption of approximately 10^4 cells on the smear, classifies each cell normal or abnormal according to its nucleus size and absorption, and totals the number of cells falling into each classification. The smear is then classified normal or abnormal depending on the fraction of cells having abnormal characteristics. Preliminary tests with the Cytoanalyser have been very promising. In a test of approximately 1000 smears, 65% of the premenopause smears and 35% of the postmenopause smears were properly identified. Plans are now underway to make a more thorough test of the screening capabilities of the instrument. If the test is successful, development of a clinical instrument will be started.

621.317.39

2831 APPLICATION OF THE METHOD OF MEASURING DISCHARGE BY COMPARING DILUTIONS TO THE DETERMINATION OF THE EFFICIENCY OF A TURBINE. C.Hermant.
Houille blanche, Vol. 14, No. 6, 808-19 (Nov., 1959). In French.

An accurate and highly sensitive colorimeter specially adapted for comparing sodium bichromate contents, was developed. Several hundred samples were analysed in the course of a detailed investigation of factors such as the instability of the diluted solutions (a few tenths of a milligram per litre), that might cause systematic errors. The last field test proved that the accidental error would be less than 1% and that the systematic error, deduced from a comparison with the thermal method, was of the same magnitude.

621.317.39 : 550.3

2832 CONTINUOUS SIGNAL SEISMOGRAPH. J.M.Crawford, W.E.N.Doty and M.R.Lee.
Geophysics, Vol. 25, No. 1, 95-105 (Feb., 1960).

Describes a method in which a continuous signal vibrator provides the source energy. Operational features, as well as some general theoretical considerations, are discussed.

621.317.44

2833 CALORIMETRIC MEASUREMENT OF THE MAGNETIC LOSSES OF RING CORES. F.Koppelmann and G.Unger.
Elektrotech. Z. (E.T.Z.)A, Vol. 80, No. 22, 773-7 (Nov. 11, 1959). In German.

A calorimeter for the determination of hysteresis and eddy-current losses in iron cores is described, and results for cold-rolled silicon–iron and normal dynamo steel sheets are compared with those obtained by electrical methods. A.J.Manuel

621.317.44 : 538.08

2834 DESIGN OF A MAGNETOMETER AND OF A MAGNETIC FIELD-GRADIENT METER. M.Spighel.
J. Phys. Radium, Vol. 18, Suppl. No. 7, 108A-111A (July, 1957). In French.

A magnetometer with an oscillating rotative coil and a linearly vibrating coil, for use in a spectrograph, is described. In order to allow a null method, a reference alternating potential, with phase and frequency identical to the signal induced in the coils, is produced

by an oscillating capacitor mounted on the same axis as the coils. The measurement is thus independent of frequency and amplitude because the two opposite potentials are both proportional to this frequency and amplitude. The measurement of a point field requires the knowledge of the successive derivatives of $(\partial^n H)/(\partial x^n)$. The geometrical characteristics of the coils is such that all derivatives up to $(\partial^3 H)/(\partial x^3)$ inclusive are null. Even in an inhomogenous field the best conditions are approached for the measurement of a point magnetic field.

621.317.44 : 538

2835 AN ELECTRONIC FLUXMETER.
R.R.Birss and J.P.Fry.
J. sci. Instrum., Vol. 37, No. 1, 31-2 (Jan., 1960).

It possesses a number of advantages over a conventional fluxmeter. It has four operating ranges and may be used with a search coil of high resistance. Provision is made for self-calibration of both the sensitivity and the linearity of the instrument. The fluxmeter is suitable for operation by a non-scientist.

621.317.49 : 577.3

2836 A MAGNETIC FLOWMETER FOR RECORDING CARDIAC OUTPUT.
H.W.Shirer, R.B.Shackelford and K.E.Jochim.
Proc. Inst. Radio Engrs, Vol. 47, No. 11, 1901-12 (Nov., 1959).

The cardiac output flow pulse (less coronary flow) can be recorded with a magnetic flowmeter applied to the unopened ascending aorta, provided: (1) the extremely large e.k.g. potentials in this region are rejected; (2) the flowmeter is phase-sensitive; and (3) the over-all instrument response is uniform from zero to 100 c/s. These requirements are fulfilled by the instrument described through the use of the square-wave method recently introduced by Denison [Abstr. 137 A of 1957; Rev. sci. Instrum., Vol. 27, No. 9, 707-11 (Sept., 1956)], and by using a high switching-frequency (480 c/s), an input high-pass filter, and a double-balanced demodulator. Two output channels of suitable response provide for simultaneous recording of instantaneous and mean flow. Each pickup sleeve is calibrated in vitro in terms of microvolts per flow rate. An electrical series calibrator provides the operational calibration. Past methods are reviewed and circuit details and design considerations are discussed.

621.317.61 : 537.7

2837 TEST SET FOR DISPLAYING THE VOLT–AMPERE CHARACTERISTICS OF TUNNEL DIODES.
A.M.Goodman.
Rev. sci. Instrum., Vol. 31, No. 3, 286-8 (March, 1960).

A test set is described which permits the display of the V–I (volt–ampere) characteristic of a tunnel diode on an oscilloscope. The circuit instabilities which usually exist when a negative resistance device is tested on a V–I curve tracer are suppressed in the unit described. The principles of design, construction, and operation are presented.

621.317.61

2838 MEASUREMENTS OF THE LIFETIME OF THE MINORITY CURRENT CARRIERS IN SEMICONDUCTORS BY MEANS OF THE MANY BRIDGE WITH A DIFFERENTIAL AMPLIFIER. S.Koc.
Slaboproudy Obzor, Vol. 20, No. 12, 744-7 (1959). In Czech.

The principle of the Many pulsed-bridge method (see Abstr. 907 of 1954) of the measurement of the minority carrier life-time in semiconductors is explained and a measuring equipment is described in some detail. The equipment consists of: (1) a frequency generator which produces the driving pulses and synchronizing pulses (to the measuring oscillograph); (2) a univibrator producing pulses of variable duration; (3) an output cathode-follower where the pulses can be varied in amplitude; (4) the actual bridge containing a set of known resistors and capacitors; (5) a differential amplifier, connected across the diagonal of the bridge; and (6) a cathode-follower whose output is connected to the oscillograph. A detailed diagram of the equipment is given. R.S.Sidorowicz

621.317.61 : 621.382.2

2839 EQUIPMENT FOR THE MEASUREMENT OF THE CONVERSION LOSS OF SILICON DIODES.
K.Vařecha and J.Pšenička.
Slaboproudy Obzor, Vol. 21, No. 1, 11-15 (1960). In Czech.

It is shown that the conversion loss of a diode (used as a mixer) is given by $L_c = g/2P_s \times (di_s/dP)^2$ where P_s is the average power, di_s is the current increment, dP is the power increment and g is the i.f. conductance of the diode. The formula is valid when the load is equal to g. P_s and dP are measured by means of a thermistor bridge and a calibrated attenuator. The conductance g can be determined by a valve voltmeter (with an auxiliary circuit), while di_s is measured directly by a microammeter. An equipment operating at microwave frequencies was constructed on the above principle. This permitted the measurement of the losses from 3 to 20 dB with an error of ±5%. A general description of the equipment is given.
R.S.Sidorowicz

INSTRUMENTS
MEASURING APPARATUS

621.317.725

2840 GENERATING ELECTROSTATIC VOLTMETERS.
G.V.Hargreaves.
Bull. elect. Engng Educ., No. 23, 58-65 (Feb., 1960).

After a brief historical survey one representative model of each of the three main types of generating electrostatic voltmeter is described; the rotating cylinder, rotating plate, vibrating plate. The applications of this instrument by various investigators are summarized. G.V.Hargreaves

621.317.725

2841 MODERN VALVE VOLTMETERS FOR ALTERNATING-VOLTAGE MEASUREMENTS.
Electronic Technol., Vol. 37, No. 3, 99-105 (March, 1960).

An illustrated survey of commercial equipment.

621.317.728 : 537.7 : 537.52

2842 A SPARK GAP WITH CROSSED CYLINDER ELECTRODES FOR VOLTAGE MEASUREMENTS.
L.Medina.
Austral. J. appl. Sci., Vol. 10, No. 4, 404-17 (Dec., 1959).

A crossed cylinder spark gap has been shown to have considerable advantages both from a constructional and operational point of view. In particular, one calibration suffices for a.c., d.c., and impulse voltages. A convenient and accurate method for measuring the peak voltage ratio of a testing transformer is described.

621.317.733 : 621.315.2

2843 THE SENSITIVITY OF A HIGH TENSION SLIDE-WIRE BRIDGE USED FOR LOCATING FAULTS IN CABLES.
E.Marchand.
Rev. gen. Elect., Vol. 68, No. 12, 661-5 (Dec., 1959). In French.

In the location of faults on underground cables, using an h.t. slide-wire bridge, the connections must be such that the resistance of the fault is in the supply diagonal of the bridge. The effect of this resistance on the sensitivity of the bridge as a function of the length of cable to the fault, and the maximum fault resistance for which a measurement is possible, are discussed in detail. In a numerical example based on a commercial bridge, the resistance of the slide-wire is 20 Ω, the resistance of the galvanometer is 11 Ω, the galvanometer constant for 1 mm deflection is 6.57×10^{-8} A, the supply voltage is 10 kV, and the resistance of the fault is 1 MΩ.
C.F.Pizzey

621.317.733

2844 A PORTABLE TEMPERATURE AND CONDUCTIVITY BRIDGE FOR FIELD USE. C.M Proctor and W.Abbott.
Texas J. Sci., Vol. 11, No. 4, 460-6 (Dec., 1959).

The instrument consists of an oscillator, a measuring bridge and a null detector, and is energized by batteries. The two-valve oscillator (f = 4 kc/s) is coupled to the bridge by a transformer with a centre-tapped secondary winding which forms two arms of the bridge. The third arm is a decade resistance box, and the fourth is a thermistor (R = 6000Ω at 0° C, 800Ω at 50° C) which functions as the temperature-sensitive element. For conductivity tests a conductivity cell is substituted for the thermistor. The output of the two-valve null detector-amplifier is applied through a transformer to headphones. The instrument will detect a resistance change of 1 part in 5000, and it is stated that over a period of one year the change of temperature calibration was less than 0.05° C.
C.F.Pizzey

621.317.74

2845 WIEN BRIDGE AS A FUNDAMENTAL STOP-FILTER IN THE DISTORTION METER. H.Gommlich.
Radio Mentor, Vol. 25, No. 12, 967-9 (Dec., 1959). In German.

Several circuits which can be used in the distortion meter to eliminate the fundamental frequency are shown and compared. Balance conditions of an unloaded Wien bridge are derived. The wide frequency range obtainable with variable capacitors (10 : 1) is stressed. The influence of the loading is discussed. Improvement of selectivity by negative feedback is explained and selectivity curves are shown. J.M.Silberstein

621.317.75 : 551.5

2846 AUTOMATIC RECORDER OF THE WAVEFORMS OF ATMOSPHERICS. B.A.P.Tantry.
Indian J. Phys., Vol. 32, No. 6, 267-75 (June, 1958).

An automatic atmospherics recorder was constructed for recording the electric field-changes during various lightning discharges. It consists of several suitable units which were designed for obtaining complete, accurate and non-overlapping oscillograms with minimum waste of recording film. Details of the component units and the various associated circuits are described.

621.317.76 : 518 : 550.3

2847 PHOTOMECHANICAL METHOD OF FREQUENCY ANALYSIS OF SEISMIC PULSES.
B.F.Howell, Jr, A.B.Andrews and R.E.Huber.
Geophysics, Vol. 24, No. 4, 692-705 (Oct., 1959).

The harmonic analysis of a seismic pulse performed by a photomechanical wave analyser is analytically related to the Fourier integral analysis of this aperiodic pulse. The calculated integral spectra of three simple analytical pulses are compared with the spectra obtained from this analyser. The integral analyses of two seismic pulses are compared with the harmonics obtained through numerical analysis. The frequency range of the integral analysis which can be performed by this analyser is from 5 to 300 c/s. Integral analyses of recorded seismic pulses up to 6 in. long (0.10 sec) and with peak amplitudes up to 0.69 in. can be performed. From an evaluation of the equipment and operational errors involved in the measurements, the integral approximations obtained from the analyser are estimated to be accurate on the average to within 1 dB in the frequency range from 5 to 100 c/s. For frequencies greater than 100 c/s, this accuracy will decrease. This is as great an accuracy as is usually obtained by numerical analysis.

621.317.761

2848 FREQUENCY METER USING A ZENER DIODE. F.Gasparini and L.Merigliano.
Energia elett., Vol. 36, No. 11, 1069-74 (Nov., 1959). In Italian.

Describes, and analyses the errors of, a circuit in which the Zener diode serves to convert the input a.c. into an approximately square wave for application, through another diode, to a capacitor–meter combination. Further diodes and batteries may be added to control the scale-shape. F.F.Roberts

621.317.78

2849 METERING ON THE LOW-VOLTAGE SIDE OF A TRANSFORMER OF ENERGY TRANSMITTED AT HIGH-VOLTAGE AND ARRANGEMENTS TO COMPENSATE FOR TRANSFORMER LOSSES. E.Morgenstern.
Rev. gen. Elect., Vol. 68, No. 11, 613-28 (Nov., 1959). In French.

The advantages of low-tension metering are discussed, and the value of the transformer losses relative to throughput are considered. Usual methods for taking account of these losses are reviewed, and more detailed consideration is given to the use of loss compensating devices. Two new types are described, one uses an analogue arrangement and is recommended for less important metering applications. In the other, a special relay system is used to inject fixed amounts of charge into the metering circuits, at time intervals controlled by I^2. Detailed circuit arrangements are given, which are claimed to provide exact compensation for all losses in the transformer. M.R.Dickson

621.317.785

2850 THE BEHAVIOUR OF INDUCTION METERS IN INTEGRATING AN INTERMITTENT TYPE OF LOAD. E.Giuffrida and R.Marenesi.
Energia elett., Vol. 36, No. 12, 1105-21 (Dec., 1959). In Italian.

The effect of an intermittent load is studied. The more common characteristics of this type of load are indicated and the errors arising from them in normal meters are considered. Simple approximations are derived from the theoretical relationships and the necessary tests for determining the parameters in the derived formulae are described. Finally, reference is made to the results of tests carried out under various load conditions. These results confirm the theoretical derivation. H.G.M.Spratt

MAGNETIC DEVICES AND MATERIALS

621.318.1 : 621.374.32 : 538.2 : 539.2

OPERATING CHARACTERISTICS OF A THIN FILM MEMORY.
See Abstr. 2298

621.318.12 : 621.374.32

2851 EQUIVALENT CIRCUITS OF FERRITE CORES IN A WIDE FREQUENCY RANGE. Yu.P.Mel'nikov.
Radiotekhnika, Vol. 14, No. 12, 58-68 (Dec., 1959). In Russian.

Frequency characteristics of permeability and loss factor are less convenient for designing pulse transformers than equivalent circuits which have the same frequency dependence. A simple LRC equivalent circuit is analysed. A method is shown for determining its parameters from the physical parameters of the material. L is determined by the initial permeability, and R and C are determined by the critical frequency and the loss factor. These can be found by superposing characteristics of the equivalent circuit on the experimentally obtained characteristics of the material. Another equivalent circuit discussed contains two inductors and one resistor. A more accurate circuit is suggested consisting of LRC in a series connection and another inductance in a shunt. Frequency range of the validity of equivalent circuits is discussed. J.M.Silberstein

621.318.12 : 621.374.32

ALL-TRANSISTOR MAGNETIC-CORE MEMORIES.
See Abstr. 2301

621.318.13

2852 INFLUENCE OF THE DIMENSIONS OF TOROIDAL CORES ON THEIR STATIC MAGNETIC PROPERTIES. M.A.Rosenblatt.
Avtomat. i Telemekh., Vol. 19, No. 8, 788-99 (1958). In Russian. English summary: PB 141096T-7, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

The influence of the o.d./i.d. ratio of toroidal cores on their magnetization curves and hysteresis loops is considered. Formulae for the determination of these characteristics are given. It is shown that the influence of this ratio is greatest for magnetic materials with a rectangular hysteresis loop or with a sharp knee on the magnetization curve.

621.318.13

2853 HIGH-POWER EFFECTS IN FERRITE DEVICES. P.E.Seiden and H.J.Shaw.
Proc. Inst. Radio Engrs, Vol. 48, No. 1, 122 (Jan., 1960).

The performance of ferrite devices deteriorates at power levels lower than would be expected by analogy with saturation effects in paramagnetic resonance. The effect is due to unstable growth of spin waves which extract energy from the uniform precession. The threshold for the onset of decrease of susceptibility depends on the r.f. field, the linewidth of the sample, the saturation magnetization and the linewidth of the spin wave which becomes unstable. Measurements of linewidth and threshold were made and spinwave linewidth calculated. Values of the critical field threshold power are derived and compared with experimental results. R.C.Glass

621.318.13

2854 SOME ASPECTS OF THE STABILITY OF PERMEABILITY OF FERRITES. R.Smith.
Proc. Instn Radio Engrs Australia, Vol. 20, No. 12, 733-6 (Dec., 1959).

Deals briefly with some of the more well-known sources of variation of ferrite permeability, and also discusses the lesser-known phenomenon of the effect of an intense unidirectional magnetic field and subsequent demagnetization on permeability.

621.318.2 : 538.1

2855 THE PULSE MAGNETIZATION OF PERMANENT MAGNETS. N.M.Rodigin.

Fiz. Metallov i Metallovedenie, Vol. 6, No. 2, 368-9 (1958). In Russian.

Points out that the usual d.c. magnetization of permanent magnets amounts to three processes, the first and last of which are transient (on switching on and off), whilst the second is steady-state. The second process is unnecessary and the third unavoidable. Pulse magnetization basically requires an ignitron, thyratron, peak transformer and capacitor. For a circuit working directly off 50 c/s a.c. supplies, see Rodigin, Fiz. Metallov i Metallovedenie, Vol. 4, No. 2, 377-8 (1957). The greatest cross section of magnico alloy so far pulse-magnetized is 15 cm^2. Advantages of the method are compact equipment, economy and saving of time. D.E.Brown

621.318.3

2856 PULSATION OF THE ATTRACTIVE FORCE OF SINGLE-PHASE ELECTROMAGNETS. C.Steinberg and V.Panaite.

Electrotechnica, Vol. 7, No. 12, 435-43 (Dec., 1959). In Rumanian.

Formulae for computing the pulsation are established, and the experimental procedure for measuring this force is described. The formulae are verified experimentally and the best means of eliminating the vibrations are shown.

INDUCTORS . REACTORS RELAYS

621.318.42 : 681.142

2857 SIMULATION OF INDUCTANCE BY AN INTEGRATING CIRCUIT. D.Midgley and J.M.Stewart.

Elect. Rev., Vol. 166, No. 7, 281-5 (Feb. 12, 1960).

The basic circuit is an operational amplifier connected as an integrator, with an additional resistance connected between output and input, which simulates an inductance whose value and Q factor may be independently assigned. The object is to use this device as a circuit element to replace a true inductor. A theoretical analysis is given with curves of the results. More advance methods are discussed using two amplifiers, and with positive feedback to increase the effective amplifier gain. K.C.Garner

621.318.42

2858 A CONTRIBUTION TO THE ANALYTICAL SOLUTION OF A MAGNETIC CIRCUIT. M.Pavlák.

Elektrotech. Obzor, Vol. 49, No. 1, 27-9 (1960). In Czech.

The circuit consists of an iron core and air gap in series. By suitable approximation the magnetic field-induction relation can be expressed by a single analytical function, whose exponent can be easily read from a graph. Errors and limits of validity of this method are briefly discussed. N.Klein

621.318.56

2859 A PUNCHED-CARD METHOD FOR THE SYNTHESIS OF SWITCHING SYSTEMS. V.I.Shestakov.

Avtomat. i Telemekh., Vol. 19, No. 6, 592-605 (1958). In Russian. English summary: PB 141096T-5 obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

Deals with a vector–algebraic method of synthesis of sequential two-position-relay switching systems by using special cards. The method is available both for autonomous and nonautonomous relay systems.

621.318.56

2860 SYNTHESIS OF RELAY CIRCUITS FOR FIXED TRANSPOSITIONS. I.S.Daniluk.

Avtomat. i Telemekh., Vol. 20, No. 3, 304-12 (1959). In Russian.

The operating conditions of relay circuits for determining the order of closing of n contacts in form of n^2 Boolean functions are formulated and corresponding circuits are given. The circuits under consideration are analysed. Analysis shows the possibility of reducing the total number of relays, and more economical circuits are suggested.

621.318.56

2861 MINIATURE RELAYS FOR USE IN ELECTRONIC EQUIPMENTS. N.E.Hyde.

Research, Vol. 13, No. 3, 105-14 (March, 1960).

The conditions in which guided missiles and space vehicles must operate, and the high degree of reliability required, necessitates special attention to miniaturization and methods to combat severe shock and vibration. The relays described withstand vibration levels far in excess of present requirements and introduce new types admirably suited to present trends in highly reliable, small volume ground equipment generally.

ELECTROSTATICS . CAPACITORS

621.319.2 : 537.2

2862 DECAY OF WAX ELECTRETS. M.M.Perlman.

J. appl. Phys., Vol. 31, No. 2, 356-7 (Feb., 1960).

The internal field within an electret can be varied by changing the spacing and arrangement of shielding electrodes ("partial shielding"). The application of this technique to rosin-wax electrets shows that the charge decay observed upon unshielding electrets is caused primarily by volume polarization due to internal field rather than by external ion collection.

621.319.33 : 621.317.333.8

2863 CALCULATION OF THE CURRENT IN NON-LINEAR SURGE-CURRENT-GENERATOR CIRCUITS. T.F.Monahan.

Proc. Instn Elect. Engrs, Monogr. 376 S, publ. April, 1960, 4pp. To be republished in Part C.

Surge-current generators are used to test non-linear resistors and surge diverters. Although the circuit is basically very simple, it is possible to calculate the surge current only by numerical solutions of the differential equation for particular values of the parameters. The results of such calculations made at Manchester University on the differential analyser and the electronic computer are given. The application of the results to certain practical problems is discussed.

621.319.43 : 621.382.23

2864 LOW-FREQUENCY VARICAPS. L.S.Berman, A.P.Landsman and V.K.Subashev.

Radiotekhnika, Vol. 14, No. 12, 69-70 (Dec., 1959). In Russian.

A brief description of large size monocrystalline silicon p–n junction varicaps, suitable for l.-f. applications (filters, balanced modulators, dielectric amplifiers, etc.). Formulae for min. and max. operating frequencies are quoted in terms of equivalent Q, depletion layer capacitance and the junction resistance and shunting conductances. Typical performance and dimensional values are described, illustrated by curves plotting Q v. freq. (10^2 to 10^5 c/s) and v. applied reverse voltage. A.Landman

621.319.5:537.52

2865 SUPPRESSION OF COUNTER-EMISSION IN COMPRESSED AIR. APPLICATION TO HIGH-VOLTAGE GENERATORS AND ELECTROFILTERS. Nguyen-Trinh Dzoanh.

C.R. Acad.Sci. (Paris), Vol. 250, No. 6, 1001-3 (Feb. 8, 1960). In French.

The undesirable effect of counter-emission in the functioning of high-voltage generators and electrofilters is briefly discussed. Some results are presented which were obtained using an experimental arrangement consisting of a fine wire surrounded by a coaxial cylinder, the inner surface of the latter being covered with fine nylon cloth to initiate counter-emission. These indicate that counter-emission can be suppressed by using air, for example, at pressures of several kg/cm^2. Finally the advantages of using compressed gases in high-voltage generators and electrofilters are summarized. A.E.Kay

621.319.5

2866 ELECTROSTATIC POWER GENERATION FOR SPACE PROPULSION. O.P.Breaux.

Elect. Engng, Vol. 78, No. 11, 1102-4 (Nov., 1959).

The advantages of electrostatic generators for ion propulsion in space vehicles are discussed. They can function in vacuum and

generate power at high voltages with high efficiency. In particular it is suggested that the potentialities of the rotating-plate generator, similar to those developed by the French company S.A.M.E.S., have not been fully explored. A number of proposed designs are briefly mentioned, including a 100 kW, 8-pole multiplate machine delivering 1 A. This machine would measure about 15 in. in diameter and 10 in. long. A.E.Kay

621.319.5

2867 ELECTRIFIED FIBROUS AIR FILTERS. J.W.Thomas and E.J.Woodfin.
Trans Amer. Inst. Elect. Engrs II, Vol. 78, 276-8 (1959) = Applic. and Industr., No. 45 (Nov., 1959).

The two principal methods of air filtration, by mechanical separation and electrostatic precipitation, are compared and then the advantages of a combination filter employing a packing of fibre-glass in an electrostatic precipitator are indicated. Tests to evaluate the efficiencies of such filters are described. The results show that the packing considerably improves the performance of an electrostatic precipitator for filtering cigarette smoke. Air conditioner filters one in. thick can be designed with a 50% efficiency for filtering cigarette smoke at 200 ft/min and less than 0.05 in. pressure drop by using fibre-glass-packed electrostatic precipitators. A.E.Kay

621.319.51

2868 THE CHARACTERISTICS OF TECHNICAL SPARK GAPS WITH STRONGLY INHOMOGENEOUS FIELD. W.Woboditsch.
Wiss. Z. Tech. Hochsch. Dresden, Vol. 8, No. 4, 869-91 (1958-59). In German.

Results are given of an investigation on corona discharge in air using point–plane gaps. Three points were used viz. two steel wires with a hemispherical end and a sharp end (30° angle), and a steel needle. Visual observation of the discharge point by telescope was supplemented by RIV measurements. The negative-point V–I characteristics obtained consisted of four ranges; (1) dark discharge (mean gap current $I < 10^{-7}$ A); (2) impulse corona ($I = 10^{-7}$ to 10^{-4} A, Trichel impulses of the shape 0.03/0.1 μsec and frequency $\sim 10^3$ - 10^4 pulses/sec); (3) continuous corona ($I = 10^{-4}$ to 5×10^{-4} A); (4) arc discharge. Four ranges also existed with the positive point; (1) dark discharge; (2) impulse corona (only within very narrow limits, impulse frequency varying 0– 3×10^3 – 0 pulses/sec). (3) continuous corona; (4) positive breakdown streamer (impulse shape 0.03/0.3 μsec, frequency 2×10^3 to 2×10^4 pulses/sec). On a.c. the phenomena that take place during the negative and positive half-waves were the same as these for the corresponding d.c. voltages. The number of charge carriers in one impulse was found to be the same as that in a single electron avalanche (1.8×10^8 electrons trons). For negative points the impulse frequency decreased with gap length for a constant voltage but was independent of length for a constant current. Both static and dynamic V–I curves are presented and the difference in the shape of the static curve for a gas discharge tube and a spark gap is explained. The a.c. breakdown voltage characteristic for the "transition region" (s = 5 - 15 cm) were investigated statistically. A scattering of up to ±24% of a mean value corresponding to the mean breakdown gradients of 7 and 3.5 kV/cm is reported. E.M.Dembinski

LAMPS . ILLUMINATION

621.327.4

2869 HIGH PRESSURE MERCURY VAPOUR LAMPS AND THEIR CONTROL GEAR. K.H.Bodenhausen.
Elektrizitätsverwertung, Vol. 35, No. 1-2, 1-8 (Jan.-Feb., 1960). In German.

The behaviour of an HPMV lamp in a circuit with a purely resistive ballast is compared with that when the ballast is inductive or capacitive. In particular, the starting current is higher and the rise of light output more rapid. The use of a capacitor in series with a choke is now becoming popular. The effects of failure of the control gear are described. J.W.T.Walsh

621.327.534.15

2870 TEMPERATURE CONTROL IN FLUORESCENT LAMPS WITH HEAVY LOADING. H.J.Arit and H.Kümmritz.
Elektrizitätsverwertung, Vol. 35, No. 1-2, 9-14 (Jan.-Feb., 1960). In German.

Increasing the loading of a fluorescent lamp increases the lamp temperature and so decreases the efficiency. The result of cooling the walls artificially is to increase the efficiency. Three types of lamps in which the vapour pressure is reduced are described: (a) by local cooling of a protuberance in the wall of the tube; (b) by the provision of screens over the electrodes; or (c) by the use of a tube with a series of grooves. It is pointed out that the effect of such devices may be nullified if the lamps are used inside fittings designed for lamps with normal loading. J.W.T.Walsh

621.327.534.15

2871 FLUORESCENT LAMPS WITH HEAVY LOADING. H.J. van Boort.
Elektrizitätsverwertung, Vol. 35, No. 1-2, 15-19 (Jan.-Feb., 1960). In German.

In the high-power lamps now available the area of the wall is increased and at the same time a small protuberance is provided, so that this part of the wall can be at a temperature of about 40°C, with the result that the vapour pressure in the tube is kept down to its normal value. The loading is 125 W, while the dimensions are those of a normal 65W lamp. The efficiency is 58 lm/W and the light output per unit length is double that of the normal 40 W lamp. J.W.T.Walsh

621.327.534.15

2872 ELECTRIC LAMPS AND ACCESSORIES. F.Knobel.
Elektrizitätsverwertung, Vol. 35, No. 1-2, 20-5 (Jan.-Feb., 1960). In German.

A general discussion of the characteristics of electric lamps with particular reference to discharge lamps, ballasts and starters. The effect of cold starting on the life of a fluorescent lamp and the effect of temperature on the re-starting voltage are described. Experiments have shown that the glow starter is not as good as the thermal starter, which gives satisfactory operation even under extreme conditions. J.W.T.Walsh

621.327.534.15

2873 HOW TO IMPROVE BALLAST TESTING. W.W.Brooks.
Illum. Engng, Vol. 54, No. 10, 647-50 (Oct., 1959).

Comparison of fluorescent lamp light-output on a reference ballast and on a ballast under test is an established procedure. It is subject to difficulties arising from irregular lamp behaviour. These are shown to be substantially diminished by localized temperature control of part of the lamp. Supplementary investigations are in hand. C.E.Williams

621.327.534.3

2874 MOTION-PICTURE PROJECTION WITH A PULSED LIGHT SOURCE. P.Hoekstra and C.Meyer.
Philips tech. Rev., Vol. 21, No. 3, 73-82 (1959-60).

Describes an illumination system in which the mercury lamp is pulsed, thus producing light only when it can be usefully employed and rendering a shutter superfluous. At the same power consumption, this gives twice as much light on the screen as obtained from a continuously burning lamp, half of whose output is intercepted by a shutter. With a projection lens having a relative aperture of f 2, the luminous flux on the screen is 4800 lm, and with a lens of relative aperture f 1.6, as much as 6000 lm. The lamp consumes 800 W, so that the efficiency is respectively 6 and 7.5 lm/W on the screen, compared with 2.5 lm/W in the case of a carbon arc. Owing to the heavier instantaneous loading during the pulses the continuum in the spectrum is intensified with respect to the spectral lines, resulting in good colour rendering. Three light flashes of about 2.5 ms duration are emitted per frame. This gives a strikingly flicker-free picture, even when the picture is very bright and wide. Apart from the illumination system proper, the power supply equipment is also discussed. The mercury lamp employed, type SPP 800 W, is a dosed type and was specially developed for pulsed operation in motion picture projectors. Some particulars of its development are given.

628.971.6

2875 PRESENT STATE OF STREET LIGHTING IN THE FEDERAL GERMAN REPUBLIC. W.Schmidt.
Elektrizitätsverwertung, Vol. 35, No. 1-2, 26-32 (Jan. - Feb., 1960). In German.

A brief resumé of some of the provisions of the German Standard for Street Lighting is followed by an account of present practice and

trends. In particular, the desire to avoid glare has led to the production of fittings in which the apparent area of the bright portion is reduced. High-power lights are replacing groups of smaller lamps at road junctions and in open areas. A survey of the development of street lighting in Germany from 1955 to 1959 shows that, while filament lamps are still numerous, they are steadily being replaced by discharge lamps. J.W.T.Walsh

ELECTROCHEMISTRY

621.357.7 : 621.317.39

DETERMINATION OF THE THICKNESS OF PLATING BY MEASURING THE THERMAL E.M.F. See Abstr. 2821

ELECTRIC HEATING

621.365

2876 ECONOMIC APPRAISAL OF PRESENT-DAY DOMESTIC HEATING SYSTEMS. H.Hagen.

Elektrotek. T., Vol. 73, No. 5, 73-80 (Feb. 15, 1960). In Norwegian.

The annual energy consumption in Norway for domestic heating is shown for each type of fuel, including electricity. For 1955-56 the total consumption for this purpose was 12 GWh, 3.5 of this in electric heating. Comparative charts are given for the various forms of heating showing the total annual costs for detached houses, semi-detached houses and blocks of flats, with both good and poor thermal insulation. It is concluded that electric heating supplemented by wood firing is the most economical, in particular, for the well-insulated small house. G.N.J.Beck

621.365 : 621.311.25

2877 THE ECONOMICS OF ATOMIC CENTRAL DISTRICT HEATING PLANTS IN SWEDEN.

S.Ekefalk, P.H.Margen and T.Nytén.

World Power Conference, Canadian Sectional Meeting, Montreal (1958) Section B_2, Paper 59 $B_2/8$, 19 pp.

Sweden has large deposits of uranium in low-grade oil shales, but, because hydro-electric stations will be able to meet the requirements for electrical energy for two decades to come, the first industrial nuclear stations are intended for district heating and will take the place of oil-fired stations. The reactors use natural uranium with heavy water as the moderator. Two types of station are under construction: one, called "Adam", located near Västeras, 100 km west of Stockholm, to supply heat only; the other called "Agesta", located near Farsta, a new suburb to the south of Stockholm. For a nuclear plant producing heat only, the most economic size is generally equivalent to 50% to 55% of the maximum heat demand on the system, the rest being supplied by a conventional plant. In the latter, the cost of fuel is the dominating part of the cost of heat, whereas in a nuclear plant the capital charges are the dominating factor. The nuclear plant should therefore take the base load and the conventional plant the peak load. The total heat demand on the "Agesta" system is estimated to amount to 140 MW in the early sixties. The base load, amounting to about 70 MW, will be taken by the nuclear station, with an estimated annual load factor of about 50%, and the peak load, with a load factor of about 10%, by low-temperature oil-fired boilers. The report contains diagrams showing the layout of the stations, as well as load curves. E.W.Golding

621.365.2

2878 RESULTS OBTAINED WITH INDUCTIVE STIRRING IN ARC FURNACES. P.E.Hammarlund and B.Hanas.

Asea J., Vol. 32, No. 10-11, 147-56 (1959).

621.365.2 : 681.142

2879 ANALOG COMPUTER SET UP TO CONTROL POWER IN ELECTRIC ARC FURNACES.

Yu.M.Alÿshev, L.V.Fitsner and L.I.Shevchenko.

Avtomat. i Telemekh., Vol. 20, No. 2, 206-10 (1959). In Russian.

621.365.22 : 621.316.728

LOAD CHARACTERISTICS OF A SUBMERGED-ARC SILICON-SMELTING FURNACE. See Abstr. 2764

621.365.3 : 62

2880 RESISTANCE HEATED HIGH VACUUM FURNACE FOR TEMPERATURES TO 1400°C. J.Cohen.

Rev. sci. Instrum., Vol. 31, No. 3, 267-70 (March, 1960).

An experimental high-vacuum furnace with a platinum–rhodium resistance heating element is described; it is operable also in oxygen or other gases up to pressures of at least 10^{-3} mm Hg. The furnace is assembled from readily obtainable equipment, and knife-edge vacuum seals are used throughout. The uniform hot zone is approximately $1\frac{3}{32}$ in. in diameter and 2 in. long. The power required for 1400°C, the maximum safe operating temperature, is about 1 kW; at this temperature the pressure is ~ 10^{-6} mm Hg. This furnace is suitable for electrical conduction studies as well as for heat treatment, etc.

621.365.32 : 536.5

2881 SELF-SUPPORTING HEATING ELEMENT. J.Rothstein.

Rev. sci. Instrum., Vol. 31, No. 3, 306-7 (March, 1960).

A heating element design is described, applicable to graphite or sheet metal, which has an electrical resistance comparable to a helix and a structural rigidity comparable to a cylinder. Incomplete cuts perpendicular to the axis create a number of electrically long paths in parallel, each with relatively short distances between regions of mechanical support.

621.365.4

2882 THE PRINCIPLES AND PRACTICE OF ELECTRIC FLOOR-WARMING. R.M.Lang and R.F.Richardson.

Elect. J., Vol. 164, No. 8, 496-9 (Feb. 19, 1960).

Details are given in tabulated form of the embedded and withdrawable systems of floor-warming and various methods of control are discussed. The advantages of floor-warming are outlined and actual operating costs of all-electric flats in the South of Scotland are tabulated. Typical examples of private houses with floor-warming showing the annual consumption and costs of electricity for all purposes, are listed. Central Electricity Generating Board Digest

621.365.51

2883 THREE-PHASE INDUCTION HEATING COILS. N.V.Ross.

Trans Amer. Inst. Elect. Engrs II, Vol. 78, 291-4 (1959) = Applic. and Industr., No. 45 (Nov., 1959).

It is shown that a uniform temperature pattern can be obtained over the length of an inductively-heated billet using 3-phase 60 c/s supply. Examples of calculations are given. V.G.Welsby

ELECTRIC WAVES AND OSCILLATIONS

621.371 : 538.56

2884 THE DEPENDENCE OF REFLECTION ON INCIDENCE ANGLE. R.Redheffer.

I.R.E. Trans Microwave Theory and Tech., Vol. MTT-7, No. 4, 423-9 (Oct., 1959).

A lossy dielectric sheet has complex dielectric constant $\epsilon = \epsilon(\chi)$ and complex permeability $\mu = \mu(\chi)$, where χ is the distance to one interface. This sheet is backed by a conducting surface and used as an absorber. If $|\epsilon(\chi)\mu(\chi)| \gg \epsilon_0\mu_0$, so that $(\epsilon/\epsilon_0)(\mu/\mu_0) - \sin^2\theta$ is nearly independent of the incidence angle θ, then the amplitude reflection $R(\theta)$ is wholly determined by $R(0)$. Typical results: when $R(\theta_0) = 0$ at one polarization, then at $\theta = \theta_0$ the reflection for the other polarization corresponds to a voltage standing-wave ratio $= \sec^2\theta_0$. At perpendicular polarization $\max |R(\theta)|$ on (θ_1, θ_2) is least, for given $|R(0)|$, if $R(0)$ is real and positive; and then $R(\theta) = 0$ at $\tan^2\theta/2 = R(0)$. But for parallel polarization $R(0)$ must be real and negative to get optimum performance. When the absorber functions at both polarizations the best obtainable result is $|R(\theta)| = \tan^2\theta/2$, no matter what interval (θ_1, θ_2) is specified. The error in the approximation is investigated theoretically and experimentally. A complete set of graphs is included, suitable for design of those absorbers to which the theory applies. The analysis also yields an exact expression for the limiting behaviour of the reflection at grazing incidence. This can be used in problems such as computation of the field due to a dipole over a plane earth. The theory of the Salisbury screen is re-examined as an aid in checking the other developments.

LINES . NETWORKS . FILTERS

621.372.2 : 621.315.1

2885 VOLTAGE, CURRENT AND POWER IN MATCHED AND UNMATCHED LINES ACCORDING TO THE GENERAL THEORY OF LINES. A.Kammerer.

Elekt. Bahnen, Vol. 30, No. 8, 179-87 (Aug.); No. 9, 205-10 (Sept., 1959). In German.

The general theory, developed first for wire telegraphy and telephony, applies as well to power and high frequency lines. The essential differences and the distribution of currents etc. along lines with low (power) and high (telecommunication) attenuation for imperfect and perfect matching between load and line are dealt with. Mathematical treatment is supplemented by polar diagrams. Relations between line parameters, propagation constant, characteristic impedance and the elements of a corresponding T-network are discussed as well as the illustration by standing and travelling waves.

H.R.J.Klewe

621.372.41

2886 OSCILLATING SYSTEMS WITH ONE VARIABLE ELEMENT. W.J.Cunningham.

J. Franklin Inst., Vol. 269, No. 2, 81-92 (Feb., 1960).

A passive electrical circuit composed of capacitance, inductance, and resistance in series is analysed with the condition that the capacitance is caused to change monotonically with time. It is further assumed that dissipative effects are small enough to allow oscillation in the circuit. The changing capacitance produces changes in both the instantaneous frequency and the amplitude of oscillation. Amplitude changes can be related to the energy required to produce the change in capacitance. By causing the capacitance to vary appropriately, the amplitude of oscillation can be maintained constant, even though dissipative effects tend to make it decay. The instantaneous frequency may change considerably, however, under these conditions. Analogous mechanical systems are also considered briefly.

621.372.413 : 621.317.41

2887 PERTURBATION THEORY OF RESONANT CAVITIES. R.A.Waldron.

Proc. Instn Elect. Engrs. Monogr. 373 E, publ. April, 1960. 3 pp. To be republished in Part C.

A detailed derivation is given of the perturbation formula for the frequency shift on introducing a sample of ferrite or dielectric material into a resonant cavity. The purpose of this is to make clear what assumptions are involved in the derivation; it is necessary to appreciate what these assumptions are in order to design accurate experiments.

621.372.413

2888 IMPROVEMENTS IN FREQUENCY STABILITY OF CAVITY RESONATORS. H.J.Oberg.

Telefunken Ztg, Vol. 32, 265-9 (Dec., 1959). In German.

Various causes of variation of natural frequency of oscillation of cavity resonators are discussed. Methods of compensation for variation due to temperature changes, effects of coupling aperture and changes due to variation of permittivity of air are considered in some detail.

A.E.Karbowiak

621.372.44

2889 THE STABILITY OF 2-POLES WITH NEGATIVE RESISTANCE. L.Piglione.

Alta Frequenza, Vol. 28, No. 1, 25-36 (Feb., 1959). In Italian.

It is pointed out that devices exhibiting negative resistance fall into two classes, one of which contains devices which are unstable on open-circuit while the other contains devices which are unstable on short-circuit.

V.G.Welsby

621.372.5

2890 THE CORRECTION OF THE PHASE ERROR OF RC CIRCUITS IN THE VICINITY OF THEIR CUT-OFF FREQUENCY. D.Gossel.

Arch. elekt. Übertragung, Vol. 13, No. 12, 525-9 (Dec., 1959). In German.

The frequency bandwidth of integrating or differentiating circuits can be increased if a phase error is admitted and subsequently corrected by an auxiliary network. Examples are given of the design of such networks.

V.G.Welsby

621.372.5

2891 LINEAR NETWORK SYNTHESIS. G.C.Bown.

Electronic Technol., Vol. 37, No. 3, 122-6 (March, 1960).

The rational fraction approximation is obtained directly in terms of the pole–zero locations in the p-plane by a process of successive approximation. The method differs from other known successive approximation techniques in being purely graphical apart from a final numerical relaxation process. A simple step-by-step account is given of the practical procedure.

621.372.5

2892 OPTIMIZATION OF NEGATIVE-IMPEDANCE CONVERSION METHODS OF ACTIVE RC SYNTHESIS. I.M. Horowitz.

I.R.E. Trans Circuit Theory, Vol. CT-6, No. 3, 296-303 (Sept., 1959).

The optimization of the type of active RC synthesis in which the realization of complex poles of immittance functions is achieved by means of RC elements in conjunction with negative impedance conversion circuits is considered. A proof is given that an optimum decomposition exists of the polynomial whose zeros are the desired poles of the immittance function and it is shown moreover that this optimum decomposition is unique.

G.D.Sims

621.372.5

2893 LADDER-NETWORK ANALYSIS USING FIBONACCI NUMBERS. A.M.Morgan-Voyce.

I.R.E. Trans Circuit Theory, Vol. CT-6, No. 3, 321-2 (Sept., 1959).

It is shown that an RC ladder-network, of n resistive L-sections in cascade, posseses input and output impedances, and a network-attenuation, all of which are expressible in terms of the basic Fibonacci numbers.

G.D.Sims

621.372.5

2894 IMMITTANCE PROPERTIES OF NONRECIPROCAL NETWORKS. A.W.Keen.

Proc. Inst. Radio Engrs, Vol. 48, No. 2, 248-50 (Feb., 1960).

This is a development of the ideas presented in a previous communication (see Abstr. 6500 of 1959). Non-reciprocal networks are studied by introducing a topological non-reciprocal element called a "unitor".

V.G Welsby

621.372.5

2895 ANALYSIS OF COMPLEX ELECTRONIC CIRCUITS. L.Ya.Nagornyĭ and V.P.Sigorskii.
Radiotekhnika, Vol. 14, No. 12, 28-37 (Dec., 1959). In Russian.

Formulae are deduced for the fundamental quantities describing the equivalent quadripoles to which the majority of commonly used circuits may be reduced. These basic expressions are derived by using the method of conformal transformation; the results are presented in terms of tables of impedances and coefficients and two examples are given, one referring to a general quadripole and the other to a 2-stage transistor amplifer. S.C.Dunn

621.372.54 : 621.374.3

TRANSIENTS DURING PASSING OF VIDEO PULSES THROUGH L.F. FILTERS. See Abstr. 2278

621.372.542.21

2896 LADDER NETWORKS WITH CHEBŸCHEV FUNCTIONS. M.Trinchieri.
Alta Frequenza, Vol. 28, No. 5-6, 541-78 (Oct.-Dec., 1959). In Italian.

A method is given for calculating the element values of a low-pass filter having a "Chebyshev" type of insertion-loss characteristic for finite terminating impedances. Tables of element values are given to assist in the design of filters with up to 6 elements. V.G.Welsby

621.372.542.21

2897 AN ITERATIVE METHOD FOR DETERMINING LADDER NETWORK FUNCTIONS. F.F.Kuo and G.H.Leichner.
Proc. Inst. Radio Engrs., Vol. 47, No. 10, 1783-4 (Oct., 1959).

A systematic method of determining the characteristics of ladder network is described. A series of simultaneous equations is obtained by starting from the output and successively multiplying by appropriate immittances. The network functions are then obtained by taking the ratios of the various equations. T.Horrocks

621.372.543.2 : 550.3

2898 ELIMINATION OF SEISMIC GHOST REFLECTIONS BY MEANS OF A LINEAR FILTER. J.P.Lindsey.
Geophysics, Vol. 25, No. 1, 130-40 (Feb., 1960).

A technique is described for the elimination of ghost reflections on magnetically recorded seismograph records by means of a linear filter. The application of this filter does not alter the character of primary reflections although eliminating the ghost reflections. The principal assumption made in the development of the technique is that the effect of a.g.c. in altering the amplitude ratio of primary and ghost reflections is uniform for all record time. A realization of the required filter is given and a measurement technique is outlined for detecting the existence of ghost reflections based on the autocorrelation function of the seismograph trace.

621.372.57

2899 REPRESENTATION OF NOISE IN LINEAR TWOPORTS. Proc. Inst. Radio Engrs, Vol. 48, No. 1, 69-74 (Jan., 1960).

This is a tutorial paper, written by the Subcommittee on Noise, I.R.E. 7.9, to provide the theoretical background for some of the I.R.E. Standards on Methods of Measuring Noise in Electron Tubes. The general-circuit-parameter representation of a linear two-port with internal sources and the Fourier representations of stationary noise sources are reviewed. The relationship between spectral densities and mean-square fluctuations is given and the noise factor of the linear twoport is expressed in terms of the mean-square fluctuations of the source current and the internal noise sources. The noise current is then split into two components, one perfectly correlated and one uncorrelated with the noise voltage. Expressed in terms of the noise voltage and these components of the noise current, the noise factor is then shown to be a function of four parameters which are independent of the circuit external to the twoport.

621.372.6 : 621.391

2900 THE PRACTICAL SIGNIFICANCE IN COMMUNICATION PROBLEMS OF THE RELATIONSHIP BETWEEN THE HILBERT TRANSFORM AND HARMONIC ANALYSIS. G.Wunsch.
Arch. elekt. Übertragung, Vol. 13, No. 12, 503-8 (Dec., 1959). In German.

All the important frequency functions encountered in network theory are regular functions of the complex frequency in the right-hand half-plane. This is the reason why the real and imaginary parts of such functions must be Hilbert transforms of each other. It is shown that this type of transformation can be reduced to a harmonic analysis, thus simplifying calculation. V.G.Welsby

621.372.6 : 621.317.78

2901 A THEORY OF STEADY FORCES IN VARIABLE-PARAMETER NETWORKS. W.E.Smith.
Proc. Instn Elect. Engrs, Monogr. 366 M, publ. March, 1960. 6 pp. To be republished in Part C.

Passive linear reciprocal networks with elements dependent upon a generalized coordinate x are investigated in order to evaluate the steady component of the corresponding generalized force $(F_x)_{av}$. Methods are found for expressing this force in terms of parameters measurable at the input terminals of the network. The analysis is particularly relevant to the absolute calibration of a class of square-law electrical measuring instruments, but the formalism is also applicable to other network systems where impedance is a useful concept.

621.372.6

2902 A NOTE ON THE STABILITY OF LINEAR, NON-RECIPROCAL N-PORTS. D.Youla.
Proc. Inst. Radio Engrs, Vol. 48, No. 1, 121-2 (Jan., 1960).

It is pointed out that a compact set of stability criteria for general, non-reciprocal n-ports is still not available. A contribution to the problem is made here by giving a new formula for the stability of a general 2-port network. V.G.Welsby

621.372.6

2903 ON THE ALGEBRAIC STRUCTURE OF FORMAL REALIZABILITY THEORY. V.Belevitch.
Rev. H.F., Vol. 4, No. 8, 183-94 (1959).

The postulates of the realizability theory of n-ports are discussed in detail and the equivalence of various fundamental properties of passive n-ports is established. In particular, some parts of McMillan's work (Abstr. 1817 of 1952) are reinterpreted in the language of matrix algebra, and linked with the theory based on the scattering matrix. The number of independent parameters of a general n-port of degree m is computed, thus extending Tellegen's analogue result for reciprocal n-ports.

WAVEGUIDES

621.372.8

2904 TM WAVES IN SUBMILLIMETRIC REGION. C.A.Martin.
Proc. Inst. Radio Engrs, Vol. 48, No. 2, 250-1 (Feb., 1960).

It is shown that the curious phepomenon of decreasing attenuation with frequency as $(\text{frequency})^{-3/2}$ is not observable for some TM modes in physical waveguides. Extensions to the analysis carried out previously (see Abstr. 284 of 1959) are given and the results are presented in graphical form. A.E.Karbowiak

621.372.822 : 538.56

2905 WAVE PROPAGATION IN AN INHOMOGENEOUS TRANSVERSELY MAGNETIZED RECTANGULAR WAVEGUIDE. Chen To Tai.
Appl. sci. Res. B, Vol. 8, No. 2, 141-8 (1960).

Studied with the aid of a modified Sturm–Liouville differential equation. A detailed discussion is given of the power relationship. Application of the Rayleigh–Ritz method to the approximate calculation of the eigenvalues is outlined, yielding a general secular determinental equation. Several models are proposed to illustrate how the exact eigenvalues of this new class of boundary-value problems are to be determined.

621.372.824 : 621.385.632.1

2906 OSCILLATION MODES OF HELICALLY SLOTTED WAVE-GUIDES. K.Ura, M.Terada and E.Sugata.
Technol. Rep. Osaka Univ., Vol. 8, 273-80 (Oct., 1958).

The field in a coaxial waveguide with a helically slotted inner conductor is considered. The conclusions are applicable to some other helical slotted waveguides. The wave propagating with a constant phase velocity along a helical structure does not exist generally in these circuits. The general scheme of h_o–k diagrams and

the relations between modes and space harmonics of helical structures are reviewed. The h_0—k diagram of the circuit concerned is compared with those of the helix and disk-on-rod circuit. The existence of modes whose fundamental space harmonics have negative dispersion is shown.

621.372.825

2907 SURFACE RESISTANCE OF CORRUGATED CONDUCTORS. T.Hosono.

Proc. Inst. Radio Engrs, Vol. 48, No. 2, 247 (Feb., 1960).

It is suggested that the attenuation of any waveguide whose wall is corrugated is necessarily higher than that of a plain waveguide. A proof using quasistatic treatment is given, but it is believed that the conclusions are valid under most conditions of practical significance. A.E.Karbowiak

621.372.829

2908 ATTENUATION OF ELECTROMAGNETIC WAVES PROPAGATING ALONG A HELICAL WIRE LINE. S.Kh.Kogan.

Radiotekhnika i Elektronika, Vol. 4, No. 2, 181-6 (Feb., 1959). In Russian.

The characteristic equation for propagation of e.m. waves along a helix of finite conductance is derived. From the approximate solution of the equation, formulae are obtained for calculating the phase velocity and attenuation. The variation of attenuation over a wide frequency band is illustrated for the practical case of a copper helix. (English summary PB 141106T-13, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.). R.C.Glass

621.372.831.2

2909 WAVEGUIDE BEND. D.Wray and R.A.Hastie.

Electronic Technol., Vol. 37, No. 2, 76-83 (Feb., 1960).

A design method for waveguide bends is explained. The bend is imagined to be composed of a large number of short bends binominally compensated. The resulting bend is considerably smaller than a simple binominal bend of similar performance. Some experimental results based on the design method are given and some methods of fabrication are also discussed. A.E.Karbowiak

621.372.832.43

2910 A MULTIHOLE DIRECTIONAL COUPLER FOR COMBINING TWO MICROWAVE BANDS. Y.Kværna.

Elektrotek. T., Vol. 73, No. 3, 33-8 (Jan. 25, 1960). In Norwegian.

The theory of two transmission lines with distributed coupling shows that complete power transfer from one line to the other occurs when the product of coupling per unit length and length is $\pi/2$. A multihole coupler for combining two microwave radio relay bands is described. A 500 Mc/s band in the 6 kMc/s region is completely coupled from a small waveguide to a larger quadratic one through which the 3.8 - 4.2 kMc/s band passes unaffected. The coupling slots used also introduce intrinsic coupling to the TE_{11} and TM_{11} modes in the large waveguide, but the total coupling to the undesired modes is minimized by proper choice of coupling length. The attenuation in the coupling unit described is less than 1 dB for the 6 kMc/s band and approx. 0.1 dB for the 4 kMc/s band. G.N.J.Beck

621.372.832.43

2911 A METHOD FOR ACCURATE DESIGN OF A BROAD-BAND MULTIBRANCH WAVEGUIDE COUPLER. K.G.Patterson.

I.R.E. Trans Microwave Theory and Tech., Vol. MTT-7, No. 4, 466-73 (Oct., 1959).

A new approach is made to the problem of tapering the branch impedances for broad-band performance. A taper is proposed, which, for a 3 dB branch coupler, is shown to give much better results in theory and practice than the currently used binomial taper. Simple expression are developed which enable the effects of waveguide junction discontinuities to be adequately corrected, thus allowing a greater accuracy in design to be achieved than was hitherto possible.

621.372.832.6

2912 ANALYTICAL ASYMMETRY PARAMETERS FOR SYMMETRICAL WAVEGUIDE JUNCTIONS. M.Cohen and W.K.Kahn.

I.R.E. Trans Microwave Theory and Tech., Vol. MTT-7, No. 4, 430-41 (Oct., 1959).

Presents a symtematic approach to the evaluation of junctions from the standpoint of their conformance to certain symmetries. Preferred sets of asymmetry parameters are found which are complete, minimal in number, which go to zero when the junction represented is symmetrical, and which may often be identified with a corresponding structural symmetry defect. The asymmetry parameters are first introduced for general linear junctions, but special attention is given to reciprocal and lossless junctions. The derivation of these preferred sets is based on the theory of group representations hitherto employed in the analysis of ideally symmetric junctions. One of the applications of these preferred parameters yields first-order relations among the defects of a nearly perfect hybrid-T junction which are believed to be new.

621.372.832.6

2913 PHASE RELATIONSHIPS IN SHORT-SLOT HYBRID COUPLERS. H.E.Schrank and C.H.Grauling, Jr.

Proc. Inst. Radio Engrs, Vol. 47, No. 11, 2017 (Nov., 1959).

Vector diagrams of the input and output waves of short slot couplers are considered. The anticipated phase relationships are shown to exist. A.E.Karbowiak

621.372.832.8

2914 E-TYPE X CIRCULATOR. S.Yoshida.

Proc. Inst. Radio Engrs, Vol. 47, No. 11, 2017-18 (Nov., 1959).

A 4-port circulator consisting of 2 waveguides intersecting at right angles in the E-plane with a magnetized ferrite element placed in the centre of the junction is described. Experimental curves are given for a circulator operating at approximately 9.4 Gc/s. A.E.Karbowiak

621.372.832.8

2915 AN E-TYPE T CIRCULATOR. S.Yoshida.

Proc. Inst. Radio Engrs, Vol. 47, No. 11, 2018 (Nov., 1959).

A 3-port circulator, consisting of an E-plane T containing a properly magnetized ferrite placed at a point in the junction, is discussed. Experimental results for an X-band circulator are given in graphical form. A.E.Karbowiak

621.372.832.8

2916 CIRCULATORS AT 70 AND 140 KMC. J.B.Thaxter and G.S.Heller.

Proc. Inst. Radio Engrs, Vol. 48, No. 1, 110-11 (Jan., 1960).

The circulators utilize a symmetrical Y-junction in the H-plane. Circulator action results because of a small cylinder of ferrite placed in the centre of the junction and magnetized perpendicular to the circulator plane. Performance curves for circulators employing Ferramic R.1. are given. A.E.Karbowiak

621.372.832.8

2917 A STRIP-LINE L-BAND COMPACT CIRCULATOR. L.Davis, Jr, U.Milano and J.Saunders.

Proc. Inst. Radio Engrs, Vol. 48, No. 1, 115-16 (Jan., 1960).

The circulator consists of an air spaced strip-line Y-junction with the ferrite in the form of a disk placed at the centre of the junction and magnetized perpendicular to the plane of the circulator. An insertion loss of less than 0.4 dB and an isolation ratio better than 25 dB over the band 950-1600 Mc/s was obtained. A.E.Karbowiak

621.372.837.2

2918 DUPLEXING A SOLID-STATE RUBY MASER IN AN X-BAND RADAR SYSTEM. F.E.Goodwin.

Proc. Inst. Radio Engrs, Vol. 48, No. 1, 113 (Jan., 1960).

A ferrite switch is described for providing additional TR protection in a maser system. It has an isolation of 30 dB over a 120 Mc/s bandwidth with a forward insertion loss of 0.25 dB. Using this switch the maser can be operated with less than 10 μW leak-through power with its optimum gain (25-30 dB at a p.r.f. of 416 pulses/sec). Under these conditions the measured noise temperature of the maser circulator, mixer and i.f. amplifier combined was 65°K. The overall noise-temperature including the losses due to the ferrite TR switch, TR tube waveguide and rotary joints was 173°K. For further details see Abstr. 7375 (1959). A.P.C.Thiele

621.372.85

2919 MECHANICAL DESIGN AND MANUFACTURE OF MICROWAVE STRUCTURES. A.F.Harvey.

I.R.E. Trans Microwave Theory and Tech., Vol. MTT-7, No. 4, 402-22 (Oct., 1959).

The presentation of design information such as dimensions and

tolerances is first discussed. Machining and other fabrication processes are then examined. Several methods of metal casting and associated techniques are described and the electrodeposition of waveguide components studied. Such final stages as inspection procedure, protective finishing and packaging are considered.
124 references are given.

621.372.85 : 538.56

2920 ORTHOGONALITY RELATIONSHIPS FOR WAVEGUIDES AND CAVITIES WITH INHOMOGENEOUS ANISOTROPIC MEDIA. A.T.Villeneuve.
I.R.E. Trans Microwave Theory and Tech., Vol. MTT-7, No. 4, 441-6 (Oct., 1959).

A modified reciprocity theorem forms the basis of development of orthogonality relationships for modes in waveguides and in cavities containing inhomogeneous, anisotropic media. In the lossless case certain of these may be interpreted in terms of power flow and energy storage. The special case of magnetized gyrotropic media is discussed for longitudinal and transverse magnetization.

621.372.85

2921 PROPAGATION OF ELECTROMAGNETIC WAVES IN CURVED LOADED WAVEGUIDES. A.N.Didenko.
Radiotekhnika i Elektronika, Vol. 4, No. 2, 172-80 (Feb., 1959). In Russian.

The propagation of e.m. waves in curved waveguides loaded by diaphragms or partially filled with dielectric is considered. The dispersion equations and expressions for the fields in some special cases are derived. An estimate is made of the efficiency of the various waveguide systems for application in particle accelerators. (English summary PB 141106T-13 obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.)
R.C.Glass

621.372.852.1

2922 HIGH-POWER MICROWAVE REJECTION FILTERS USING HIGHER-ORDER MODES. J.H.Vogelman.
I.R.E. Trans Microwave Theory and Tech., Vol. MTT-7, No. 4, 461-5 (Oct., 1959).

In order to obtain filters capable of handling very high power, the use of radial lines and uniform line discontinuities was investigated. Forty-five-degree tapers and uniform lines were used to design a high-power microwave filter capable of handling 700 kW at 15 lb/in^2 in a 0.900 by 0.400 inch internal diam. waveguide. In addition to filtering which results from discontinuities in the TE_{10} mode in the waveguide, high insertion-loss elements are effected when the enlarged uniform line section is larger than the TE_{10} mode waveguide wavelength and when the length of the enlarged section is approximately $(2n-1)\lambda_g/4$. Extremely large insertion losses are possible by the cascading of the elements. Tuning, in standard-size waveguide, has no effect on insertion loss of the higher-mode enlarged waveguide at its resonant frequency. Empirical design formulae are evolved and the design procedure for band-rejection filters is given, using these high insertion-loss elements.

621.372.852.1

2923 ABSORPTIVE FILTERS FOR MICROWAVE HARMONIC POWER. V.Met.
Proc. Inst. Radio Engrs, Vol. 47, No. 10, 1762-9 (Oct., 1959).

Low-reflection absorptive filters for harmonic power at microwave frequencies utilizing the cutoff properties of certain lossy periodic waveguide structures are described. Various approaches to specific absorptive filters are discussed, and experimental results demonstrate the validity of the concepts developed. Insertion loss of up to 50 dB for second harmonic power (TE_{10} or TE_{20} mode) and less than 0.1 dB for the fundamental at S-band could be accomplished using a waveguide filter 8 in. long. The v.s.w.r. is of the order of 1.5 or better throughout the entire useful frequency range. The wideband performance of the filters is characterized by the fact that satisfactory operation results if the frequency of the fundamental falls within the range of dominant TE_{10} mode propagation in rectangular guide, excluding the extreme edges of the band.

621.372.852.2

2924 A NONRECIPROCAL, TEM-MODE STRUCTURE FOR WIDE-BAND GYRATOR AND ISOLATOR APPLICATIONS. E.M.T.Jones, G.L.Matthaei and S.B.Cohn.
I.R.E. Trans Microwave Theory and Tech., Vol. MTT-7, No. 4, 453-60 (Oct., 1959).

The theoretical and experimental operation of a novel form of TEM transmission-line network capable of operation over octave bandwidths is described. This network consists, basically, of a parallel arrangement of two conductors and a ferrite rod within a grounded outer shield. The conductors may be connected in a two-port configuration which provides, in the absence of the ferrite rod, complete isolation from zero frequency to the cut-off frequency of the first higher mode. With an unmagnetized ferrite rod properly inserted, the broad-band isolation is virtually unaffected. When the rod is magnetized by an axial magnetic field, coupling occurs between the two ports by a process analogous to Faraday rotation. The device may be used as a broad-band gyrator, switch, or modulator, and with the addition of a resistance load, as an isolator. The bandwidth of these components is inherently limited only by the bandwidth capacility of the ferrite material itself.

621.372.852.3

2925 MISMATCH ERRORS IN CASCADE-CONNECTED VARIABLE ATTENUATORS.
G.E.Schafer and A.Y.Rumfelt.
I.R.E. Trans Microwave Theory and Tech., Vol. MTT-7, No. 4, 447-53 (Oct., 1959).

The treatment of mismatch errors is extended to cover variable attenuators cascade-connected in a system which is not free from reflections. The method of analysis is applicable to any number of cascaded attenuators, but only the analysis of two and three variable attenuators in cascade is presented. Graphs are given to aid in estimating the limits of mismatch error. In an example, which is considered representative of rigid rectangular waveguide systems, the limits of error are: for two attenuators in cascade, 0.19 dB in a 3 dB measurement, and 0.18 dB in a 40 dB measurement; and for three attenuators in cascade, 0.25 dB in a 40 dB measurement, and 0.23 dB in a 75 dB measurement.

OSCILLATORS . PULSE GENERATORS

621.373.4

2926 THE EFFECT OF A CATHODE IMPEDANCE ON THE FREQUENCY STABILITY OF LINEAR OSCILLATORS. C.T.Kohn.
Proc. Inst. Radio Engrs, Vol. 48, No. 1, 80-8 (Jan., 1960).

High-stability oscillators usually employ tubes having rather high values of transconductance. Excellent frequency-stability as to valve capacitance and supply-voltage changes results, but a change of the cathode impedance produces large frequency changes. Cathode-impedance changes in a valve may reach 100 ohms during its lifetime because of the growth of an interface layer between the oxide coating and the cathode sleeve. In order to reduce the effect of the cathode impedance, the g_m value must be reduced considerably, the optimum being near $1/X_g$, where X_g is the grid–cathode reactance. The ratio of the anode/grid r.f. voltages should be made equal to the ratio of grid/anode capacitances, or equal to unity. Full advantage cannot always be taken of the recommended g_m value, as this makes the oscillator more susceptible to random capacitance variations and to changes of supply voltage, but a considerable reduction below customary values is possible. In this way, the long-term stability can be improved at least ten times.

621.373.4

2927 VERY LOW FREQUENCY WAVEFORM GENERATOR (VISUAL SENSATION STIMULATOR).
G.Cartianu and A.Preda.
Telecomunicatii, Vol. 3, No. 3, 119-23 (May-June, 1959). In Roumanian.

Saw-tooth, triangular and rectangular waves with repetition frequencies from 2 to 40 c/s can be obtained with this generator. Some particular features of the bistable circuit used are discussed. The generator is utilized in a study on the production of visual sensations by nonadequate stimuli (electric pulses).

621.373.421.1 : 621.316.726

ELECTRIC METHODS FOR FREQUENCY CONTROL OF A STABLE RC OSCILLATOR. See Abstr. 2759

621.373.421.13

2928 THEORETICAL STUDY OF A TUNING PROCEDURE FOR A BRIDGE-TYPE PIEZO-OSCILLATOR.
G.Gennaro and G.Patrucco.
Alta Frequenza, Vol. 28, No. 1, 10-24 (Feb., 1959). In Italian.

In the Meacham-bridge oscillator, the reactance X_4 of the crystal is a measure of the detuning of the circuits and the resistance of the thermistor is a measure of the input to the bridge. Using these as a basis for calculation, curves are derived for the variation of the bridge input voltage with detuning of the anode circuit, for three values of grid circuit tuning (above, below and equal to the series-resonant frequency of the crystal). The curves intersect at a single point, corresponding to the crystal frequency. The validity of the tuning procedure described in the following abstract is thus confirmed. W.G.Stripp

621.373.421.13

2929 PROCEDURE FOR TUNING THE CIRCUITS OF A BRIDGE-TYPE PIEZO-OSCILLATOR. M.Boella.

Alta Frequenza, Vol. 28, No. 1, 3-9 (Feb., 1959). In Italian.

For maximum stability in a Meacham-bridge oscillator, the input and output transformers of the amplifier must be accurately tuned. It is found experimentally that the grid circuit can be adjusted so that small changes of anode tuning have practically no effect on the alternating voltage applied to the bridge. A theoretical investigation (see preceding abstract) shows that this is the correct grid-tuning point. The tuning procedure recommended is: (a) to tune the anode circuit approximately for minimum output from the bridge; (b) to tune the grid circuit so that the change of input to the bridge for small changes of anode tuning is a minimum; and (c) tune the anode circuit exactly for minimum bridge output. If the tuning capacitors have accurately graduated dials, the procedure can be perfected by tuning each circuit for minimum effect when the other is detuned by a small amount. W.G.Stripp

621.373.421.13

2930 THE EFFECT OF THE QUARTZ RESONATOR LOADING ON THE FREQUENCY STABILITY OF A CRYSTAL OSCILLATOR. G.B.Al'tshuller.

Radiotekhnika, Vol. 14, No. 12, 45-9 (Dec., 1959). In Russian.

Is mainly concerned with 4-12 Mc/s BT cut crystals in the Shembel circuit. Equations are derived for the process in which instability factors (e.g. change in supply voltage) affect the voltage on the crystal, where the effect increases with the load; a change in the crystal voltage in turn produces a change in the power dissipated in the quartz bar, which then leads to a change in the bar temperature and hence to a change in the resonant frequency. High frequency stability is shown to require a resonator load not exceeding 1-2 mW. D.E.Brown

621.373.431.1 : 621.397.332.12

2931 GRAPHICAL CHECKOUT OF MULTIVIBRATOR DESIGN. C.L.Barsony.

Electronics, Vol. 33, No. 8, 55-7 (Feb. 19, 1960).

In television receivers several factors can cause unstable horizontal-multivibrator operation. The effects of this instability are discussed. It appears that the oscillator frequency is a function of the a.f.c. control voltage of the oscillator. This transfer function can be used as an index for stable operation of the multivibrator, and graphs can be plotted showing how oscillator operation can be improved in a certain circuit. The effects of instability are also plotted graphically and compared with the ideal transfer function. E.Maanders

621.373.431.2

2932 FRAME BLOCKING OSCILLATOR.

Mullard tech. Commun., Vol. 5, 71-3 (Feb., 1960).

Describes a frame blocking oscillator in which the interaction between the controls is a minimum but at the same time the peak valve current is reasonably small.

621.373.431.4 : 621.376.32

2933 THE USE OF RELAXATION OSCILLATORS FOR PRODUCING FREQUENCY MODULATED SIGNALS. A.A.Vasil'ev.

Dokl. Akad. Nauk SSSR, Vol. 129, No. 1, 85-7 (Nov. 1, 1959). In Russian.

Discusses the basic possibilities of f.m. relaxation oscillators for f.m. work, mainly with reference to the type with single integrator, switched to input voltage + U(t) and − U(t) by an electronic switch controlled by a trigger, which is in turn controlled by a slipper limiter circuit. The integrator with a triangular output voltage is shown to be preferable, since other types of signal, e.g. sinusoidal, can easily be obtained from this by non-linear transformations. A block circuit is illustrated and discussed for multiplying the instantaneous frequency of a signal of triangular form. D.E.Brown

621.373.44

2934 A SPECIAL TRIGGER CIRCUIT. C.Mira and Y.Sevely.

C.R. Acad. Sci. (Paris), Vol. 250, No. 3, 488-90 (Jan. 18, 1960). In French.

A circuit derived directly from that of a bistable transistor flip-flop, with a common emitter resistance, has characteristics similar to a Schmitt circuit. This circuit triggers from one state to the other when a certain applied voltage is exceeded. Component values and operating characteristics are given for two variations of the circuit, one with the transistors "saturating" and the other a "non-saturating" circuit. B.Dentakevich

621.373.44

2935 A TIMING-PULSE GENERATOR. C.S.Fowler.

J. Brit. Instn Radio Engrs, Vol. 20, No. 2, 125-6 (Feb., 1960).

The equipment described generates timing pulses for general laboratory use. By reference to the MSF standard frequency transmissions, the pulses serve as time signals which do not differ from Universal Time (UT 2) by more than ±0.05 ms.

621.373.44

2936 A METHOD OF GENERATING PAIRS OF MILLI-MICROSECOND CURRENT PULSES SEPARATED BY A VARIABLE INTERVAL. J.M.Somerville.

Proc. Phys. Soc., Vol. 74, Pt 3, 378-9 (Sept., 1959).

The first pulse is formed by discharging a coaxial line through a spark gap into a similar line of variable length. The pulse is reflected at the short-circuited end of the variable line and passes through the gap a second time, with the current in the same direction as before. Reflections from the open end of the first line, with current reversal, are eliminated by a clipping valve. This is a tetrode connected as a triode, but with a resistor and capacitor in parallel between anode and grid. The capacitance determines the impedance of the valve. W.G.Stripp

621.373.442

2937 GRAPHICAL TREATMENT OF RELAXATION PHENOMENA. H.Wilpernig.

Elektrotech.u.Maschinenbau (E.u.M.), Vol. 176, No. 18, 433-6 (Sept. 15, 1959). In German.

A method is described and a diagram is developed to determine under which conditions oscillation occurs in a circuit consisting of a choke, a capacitor and a resistor connected in series. Starting from the magnetizing characteristic of the choke, the locus of the voltage at the choke and then the locus of the voltage of the series connection of resistor and capacitor are determined, both in their functional relation to the current. These loci are preferably drawn on transparent paper and the sheets are so shifted relative to each other that the sum of the three values equals the applied voltage. Then, finally, a diagram is obtained which indicates at which values of capacitance and/or resistance with a given choke oscillation occurs or is avoided. R.Neumann

621.373.444

2938 THE CONTROLLED TRIGGERING OF A SPARK GAP WITH A PRECISION OF THE ORDER 10^{-7} SEC. J.Lagasse, G.Giralt and G.Rey.

C.R. Acad. Sci. (Paris), Vol. 248, No. 23, 3287-9 (June 8, 1959). In French.

Many causes may influence the start of h.v. and m.v. controlled sparks. A method of achieving this control with high precision is indicated. M.W.Makowski

621.373.52 : 621.327.534.15

2939 TRANSISTOR D.C. CONVERTERS FOR FLUORESCENT-LAMP POWER SUPPLIES. T.Hehenkamp and J.J.Wilting.

Philips tech. Rev., Vol. 20, No. 12, 362-6 (1958-59).

Description of experimental transistor d.c. to a.c. convertors with output powers up to about 20 W. The particular application concerned here is to furnish an a.c. supply for fluorescent lamps in circumstances where efficient lighting is desired but where the only source of electricity available is a low-voltage accumulator of limited capacity. The convertors operate at frequencies of several kc/s; the advantages are that lamp efficiency is raised to about 20% higher than that obtained at 50 c/s, the ripple in the light given becomes so slight as to be imperceptible, and the bulk of the convertor and ballast can be kept down. Trial installations in a train and bus,

working with efficiencies between 62% and 65%, have given satisfactory results. An efficiency of over 80% has been obtained from more recent circuits.

621.373.52

2940 TRANSISTOR LC OSCILLATOR CIRCUITS GIVING MODERATE VALUES OF OUTPUT POWER.

Mullard tech. Commun., Vol. 5, 60-70 (Feb., 1960).

A simple procedure is described for the design of single-ended, grounded-emitter LC oscillators working at frequencies up to about $f_t/10$. The maximum frequency of operation of these circuits depends on the base resistance of the type of transistor used. Emphasis is placed on interchangeability of transistors of the same type. Design charts and formulae are provided which enable the efficiency and the amplitude of oscillation to be predicted with an accuracy of a few per cent. The output power obtainable with these circuits is limited to about 100 mW at the higher frequencies, the actual value again depending on the base resistance of the transistor. At lower frequencies, however, several times more output power is attainable. A practical circuit which will provide an output power of 90 mW at 50 kc/s with OC72 transistors is given.

PULSE CIRCUITS . DIGITAL CIRCUITS SWITCHING CIRCUITS

621.374.3 : 621.389

COMPUTATION OF MUSCLE ACTIVITY FROM THE INTEGRATED ELECTROMYOGRAM. See Abstr.

621.374.32 : 537.7

2941 DEMONSTRATION LCR CIRCUITS. T.A.Wiggins and P.W.Jackson.

Amer. J. Phys., Vol. 27, No. 5, 364-5 (May, 1959).

Describes suitable circuits for use with a square-wave generator to illustrate circuit characteristics. E.G.Knowles

621.374.32 : 539.1.07

2942 TRANSISTORISED PORTABLE COUNTING-RATE METER. W.W.Goldsworthy.

Nucleonics, Vol. 18, No. 1, 92, 94, 96, 98,99 (Jan., 1960).

Full circuit details are given of an α,β,γ-monitor with interchangeable detector probes, operating from a 10 V battery supply. Pulses are fed into a 4-stage transistor amplifier using alternate n-p-n. and p-n-p. transistors and having a gain of $\cong$ 70 dB. After differentiation they enter a univibrator metering circuit. The monitor includes a stabilized 2 kV h.t. supply generated by a Cockcroft–Walton circuit from a 2 kc/s square wave. R.D.Smith

621.374.32

2943 DESIGN FOR RELIABILITY OF SYSTEMS USING RELAYS ACTIVATED BY γ-RAY COUNTERS.

A.G.Vasil'ev and K.S.Klempner.

Avtomat. i Telemekh., Vol. 20, No. 2, 220-5 (1959). In Russian.

The relations are determined between the reliability of performance of relays activated by γ-ray detectors and the activity of the radiation source. The criteria for minimum required (and maximum permissible) radioactive intensity of the source are examined. Design formulae and the optimum counting rates, for reliable stability, are presented in the case of several given parameters of the rate-counting circuits and the relays.

B.Dentskevich

621.374.32

2944 100-CHANNEL TIME-OF-FLIGHT SPECTROMETER. H.Guillon and A.Kadjar.

Onde elect., Vol. 38, 641-7 (Aug.-Sept., 1958). In French.

621.374.32 : 518.5 : 536.48

2945 RELAXATION TIMES IN LEAD FILM, SUPERCONDUCTIVE, STORAGE ELEMENTS.

R.F.Broom and O.Simpson.

Brit. J. appl. Phys., Vol. 11, No. 2, 78-80 (Feb., 1960).

An experiment is described which measures the critical current of a lead-film Crowe cell during the first microsecond after switching The minimum writing time of such storage cells should be equal to the time required for the critical current to recover to one half of its initial value. Good correlation is found between the recovery times and the writing times for Crowe cells deposited on various substrates. Cells deposited on mica or sapphire recovered in 50 mμs, while those on glass required approximately three times as long. Measurements were also made of the critical current as a function of temperature, and these are used to derive cooling curves during the recovery phase. The cooling curves are not related to the thermal conductivities of the substrates in any simple way, probably because the rate of cooling is determined primarily by the thermal resistance between film and substrate.

621.374.32

2946 EXPERIMENTS ILLUSTRATING TRANSIENT PHENOMENA WHEN ELECTRIC CIRCUITS ARE SWITCHED. K.W.Wardrop.

Bull. elect. Engng Educ., No. 23, 36-45 (Dec., 1959).

621.374.32 : 621.382.3

2947 TRANSISTOR BIAS METHOD RAISES BREAKDOWN POINT. A.Somlyody.

Electronics, Vol. 33, No. 2, 48-9 (Jan. 8, 1960).

The collector-emitter voltage rating of a transistor is lower than the corresponding collector-base rating, and this can be a limitation in some switching circuits. By causing the emitter-base junction to be reverse-biased the collector-emitter voltage rating can be safely exceeded. This technique may be used to drive the ten cathodes of a cold cathode tube numeral indicator.

J.MacCormack

621.374.32

2948 COMPUTER SWITCHING WITH HIGH-POWER TRANSISTORS. J.S.Ronne.

Electronics, Vol. 33, No. 10, 44-7 (March 4, 1960).

The published data for power transistors do not give convenient standards for the comparison of various types when designing amplifiers. It is shown how, from the data provided, expressions may be derived which show the inter-relation of such factors as maximum collector temperature, ambient conditions, maximum collector current, collector-current rise and fall times, storage time and repetition frequency of the drive signal. The expressions are applied in detail to the design of a core-drive amplifier and several methods of reducing storage time are given. G.H.Stearman

621.374.32 : 621.318.5

2949 TREATMENT OF TRANSITION SIGNALS IN ELECTRONIC SWITCHING CIRCUITS BY ALGEBRAIC METHODS.

D.E.Muller.

I.R.E. Trans Electronic Comput., Vol. EC-8, No. 3, 401 (Sept., 1959).

If an intermediate value, $\frac{1}{2}$, in addition to the terminal values 0 and 1, is considered in switching circuits, some of the rules of Boolean algebra are no longer valid. Those which are left, however, can be used to build up a system for studying switching circuits; circuits which are equivalent in this system are more closely related than those which are merely equivalent in the Boolean sense. They now exhibit the same transient behaviour and if one of two such equivalent circuits is "spike-free", the other will be also, and conversely. G.A.Montgomerie

621.374.32 : 621.318.12

EQUIVALENT CIRCUITS OF FERRITE CORES IN A WIDE FREQUENCY RANGE. See Abstr. 2851

621.374.4

2950 A METHOD OF COMBINING TWO FREQUENCIES. L.R.Kahn.

Proc. Inst. Radio Engrs, Vol. 48, No. 1, 118-19 (Jan., 1960).

A new method of frequency synthesis is described; when two frequencies f_1 and f_2 are combined additively and the resultant wave is passed through a perfect limiter the output can be regarded as a sine wave of frequency f_1, phase-modulated by a saw-tooth wave. This signal is now passed into a phase inverter with two outputs (each of opposite phase) either of which may be selected by a switch. If this switch is operated to reverse the polarity of the output at the same frequency as the saw tooth and coincident with it, a constant phase-change will be imposed on frequency f_1, and the resultant output will be a sine wave of frequency $(f_1 + f_2)/2$. The switch control signal is derived from amplitude detection of the input signal before limiting and occurs when this amplitude is a minimum.

A.P.C.Thiele

621.374.42

2951 NEGATIVE FEEDBACK IN FREQUENCY-CHANGERS. D.G.Tucker.
Electronic Technol., Vol. 37, No. 3, 96-8 (March, 1960).

Two different forms of negative feedback are discussed. One is the usual kind, with only passive elements in the feedback path; the other has an active element in the feedback path, with characteristics identical to those of the forward path. Both can give good constancy of overall gain. Their application to frequency-changers is considered, and it is shown that while both may be useful, neither is entirely satisfactory in practice.

621.374.44

2952 NANOSECOND PULSE GENERATORS. N.Martalogu, M.Molea and N.Scînteie.
Automatica si Electronica, Vol. 3, No. 3, 126-30 (May-June, 1959).

Generators using coaxial lines and switching circuits are surveyed. Three particular types of switching circuit are analysed and some experimental results obtained by the authors are presented.

621.374.44 : 621.385.623.5

2953 THE REFLEX KLYSTRON AS A GENERATOR OF NANOSECOND PULSES. N.Martalogu, M.Molea and N.Scînteie.
Automatica si Electronica, Vol. 3, No. 5, 214-18 (Sept.-Oct., 1959). In Roumanian.

621.374.5

2954 THE PECULIARITY OF PROCESSES IN LINES WITH A NULLING CONNECTION. V.A.Solov'yëv.
Radiotekhnika, Vol. 14, No. 12, 15-18 (Dec., 1959). In Russian.

By a line with a nulling connection is meant a distributed transmission line in which one longitudinal conductor has zero resistance, that is to say, the line is of the form usually adopted for artificial electric lines. The effect of various ways of connecting the line, i.e., open, terminated, shorted and bridged with an impedance, is examined for a unit function and for a pulse input. Various waveforms are derived by a simple graphical process. It is suggested that some of the pulse-forming properties might have practical applications.

S.C.Dunn

AMPLIFIERS

(Abstracts on magnetic amplifiers appear also under Inductors . Reactors)

621.375.2

2955 NEGATIVE-CAPACITANCE AMPLIFIER NOISE. M.Robinson and J.Weinmann.
Electronic Technol., Vol. 37, No. 3, 127-9 (March, 1960).

The inherent limitations of negative-capacitance feedback, due to the finite time constant and internal noise of an actual amplifier, are discussed. It is shown that the limitation, caused by noise, applies to any circuit that is designed to reduce the input RC time constant.

621.375.2

2956 A WIDE-BAND TRIODE AMPLIFIER WITH AN OUTPUT OF 10 W AT 4000 Mc/s. J.P.M.Gieles and G.Andrieux.
Philips tech. Rev., Vol. 21, No. 2, 41-6 (1959-60).

The construction and properties of an amplifier developed for the EC 59 disk-seal triode are described. The main differences between this amplifier and one designed for the EC 157 are concerned with matching the tube to the input and output waveguides and the fact that water cooling is necessary with the EC 59. At an output of 10 W and a bandwidth of 100 Mc/s the average gain measured on a series of tubes was 8.6 dB. The maximum output obtainable without overloading the grid was 15 W. The amplifier is designed to operate from 3.8 to 4.2 Gc/s. Group-delay variations, and phase variations due to changes in amplitude of the input signal, are very small.

621.375.222

2957 AUTOMATIC COMPENSATION OF ZERO DRIFT IN ELECTROMETER AMPLIFIERS. D.E Polonnikov.
Avtomat. i Telemekh., Vol. 19, No. 7, 684-94 (1958). In Russian.
English summary: PB 141096T-7, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

621.375.222 : 537.7

2958 TRANSIENT RESPONSE OF DIRECT CURRENT AMPLIFIER SYSTEMS. R.D.Stuart.
Brit. J. appl. Phys., Vol. 10, No. 7, 326-8 (July, 1959).

The transient response of a direct current amplifier to a step function input current, is compared with its response to a spurious charge suddenly induced on the capacitance across the grid of the first valve. The behaviour of circuits consisting of simple RC networks is considered first, and this is then compared with the behaviour of a system containing an amplifier with feedback. It is shown that the problem of improving the signal-to-noise ratio for this case is one of filtering, and can be considered independently of any characteristics introduced into the system by feedback.

621.375.222

2959 COMPENSATION OF DIRECT COUPLED AMPLIFIERS AGAINST DRIFT CAUSED BY HEATER VOLTAGE FLUCTUATIONS. F.Gutmann.
Proc. Instn Radio Engrs Australia, Vol. 20, No. 11, 692-4 (Nov., 1959).

The output of a thermopile, indirectly heated from the same source which supplies the heater(s) of a direct coupled amplifier, is fed back either into the input or in series with the indicator, e.g. a meter, in a polarity to compensate the zero drift due to heater voltage fluctuations. The drift is reduced to less than one-third without sacrificing sensitivity.

621.375.225

2960 STAGGER-TUNED AND BANDPASS-COUPLED CIRCUITS IN WIDEBAND I.F. VALVE AMPLIFIERS.
Mullard tech. Commun, Vol. 5, 48-59 (Feb., 1960).

Formulae are derived for the replacement of any two equally detuned circuits in a stagger-tuned amplifier by a single bandpass-coupled pair. The implication of these formulae in the design of a multi-stage amplifier is studied, having regard to (a) gain and selectivity for a given bandwidth and (b) the limitations imposed by such parameters as valve capacitances, the Q-factor of the coils, etc. This study shows that, in a wide-band i.f. amplifier, it is generally advantageous from considerations of gain and selectivity to use bandpass-coupled coils rather than single-tuned circuits.

621.375.227 /.427

2961 DISTORTION IN CLASS A-B PUSH PULL AMPLIFIERS. I.S.Docherty and R.E.Aitchison.
Proc. Instn Radio Engrs Australia, Vol. 20, No. 12, 737-41 (Dec., 1959).

The Fourier coefficients of the current waveform for a single valve or transistor working under varying bias conditions (from class A through various degress of class AB operation to pure class B) are evaluated as a function of the angle of flow of the output current. From these results the harmonic distortion is determined for a balanced push-pull system. Modifications of these results for imperfectly balanced systems are evaluated. The manner in which these results are affected by the departure of the transfer characteristic from an ideal linear relationship is outlined. The importance of these results in practical push-pull valve and transistor amplifiers is discussed.

621.375.3

2962 APPLYING MAGNETIC AMPLIFIERS. J.R.Walker.
New York: American Institute of Electrical Engineers No. T-118 (Nov.,1959) Conference on 'Rubber and Plastics' (April 22-24,1959) 88-106.

A comparison is made between static magnetic amplifiers and rotating magnetic amplifiers and thyratron tubes. The power output in each case is taken to be 4.5 kW. It is concluded that, where a choice is possible, magnetic amplifiers should be used in conjunction with transistors or valve carrier-type amplifiers. This enables input impedance to be as high as $10^5\ \Omega$ and the input level may be lowered to 10^{-9} W for reliable operation. The overall time-response will also be less than that possible with a cascaded magnetic amplifier.

S.C.Dunn

621.375.3

2963 SELF-SATURATING MAGNETIC AMPLIFIER. I.Nagy.
Elektrotechnika, Vol. 52, No. 10, 430-46 (Oct., 1959). In Hungarian.

Some fundamental aspects of magnetic amplifiers are discussed.

Treatments based on simplified forms of hysteresis loops are given for the general case of magnetic amplifiers with positive feedback and also for self-saturating magnetic amplifiers with 100% positive feedback. L.Csuros

621.375.3

2964 CORE CHARACTERISTICS AND MAGNETIC AMPLIFIER PERFORMANCE. Y.Sakurai and E.Ichikawa.
Technol. Rep. Osaka Univ., Vol. 8, 253-60 (Oct., 1958).

In self-saturating magnetic amplifiers, the control characteristics depend on the shape of the hysteresis loop of the magnetic core. The influence of the slope of the hysteresis loop on control characteristics was investigated by both analysis and experiment. To remove the effect of eddy current it is assumed that the a.c. hysteresis loop equals to the d.c. loop. Experiments using the cores demonstrated that the analytical results are reasonable. It is concluded that the characteristics conform to that expected from the hysteresis loop and that the slopes of the flanks of the hysteresis loop cause the lower knee of the control characteristics to shift under the free magnetization condition and that the residual inductance of the reactors causes the upper knee to shift. From the observation of waveforms it is clear that the peak value of the current determines the flux reset.

621.375.3 : 621.316.718

SUPPLYING A D.C. MOTOR DIRECTLY THROUGH A MAGNETIC AMPLIFIER. See Abstr.2738

621.375.3/.4

2965 HIGH-SPEED PUSH-PULL MAGNETIC–TRANSISTOR AMPLIFIER FOR A SERVODRIVE.
V.S.Volodin, E.D.Larin, M.A.Rozenblatt and G.V.Subbotina.
Avtomat. i Telemekh., Vol. 20, No. 3, 323-30 (1959). In Russian.

Results are given of a magnetic–transistor amplifier developed for the control of a two-phase induction motor with transient time equal to 1–1.5 cycles of the supply frequency when power gain is 1.5×10^6.

621.375.4

2966 CONCERNING A NON-LINEAR EFFECT IN TRANSISTOR AMPLIFIERS WITH FEEDBACK. I.Gumowski.
C.R. Acad. Sci. (Paris), Vol. 249, No. 23, 2514-16 (Dec. 9, 1959).
In French.

A nonlinear effect, which is very difficult to observe by direct measurements on the transistors, becomes pronounced when they are used in feedback amplifiers. The effect is described, and an attempt is made to analyse the causes. S.A.Ahern

621.375.4

2967 ON A NON-LINEAR EFFECT IN TRANSISTOR AMPLIFIERS WITH FEEDBACK. I.Gumowski
C.R. Acad. Sci. (Paris), Vol. 250, No. 5, 822-4 (Feb. 1, 1960).
In French.

In transistor amplifiers working with a high degree of feedback, there appears a nonlinear effect which reduces considerably the margin of available stability. A graph is plotted showing the measured phase characteristic of a transistor amplifier with feedback, and compared with the theoretical curve, assuming that the amplifier was linear. In order to establish a correlation between this difference in the phase characteristics the distortion encountered in the amplifier with feedback is plotted. It is assumed that the nonlinear effect is due mainly to the variation of transit-time of the current carriers with the collector voltage of the transistors. Assuming the hypothesis to be correct, the functioning of the feedback amplifier is described by a mathematical expression. A.C.Brown

621.375.4

2968 LINEAR-PHASE TRANSISTOR AMPLIFIER. P.Hirsch.
Elect. Engng, Vol. 78, No. 12, 1184-9 (Dec., 1959).

The response of a simple shunt-compensated transistor-amplifier stage is shown to be characterized in the complex p-plane by two poles and a zero. The three possible stable pole-zero configurations are examined in turn but the cases in which the poles are complex conjugate with negative real parts are examined in detail. It is concluded that: (1) it is not possible to realize both maximal flatness and linear phase responses simultaneously; (2) it is possible to realize critical damping and maximal flatness simultaneously; and (3) it is possible to realize critical damping and linear phase responses simultaneously. It is also shown that maximum gain-bandwidth improvement over the uncompensated stage is increased by a factor of 1.3 and that the design leads to circuits whose response is relatively insensitive to variation in the compensating inductance. J.MacCormack

621.375.4

2969 SOME PROBLEMS IN THE DESIGN OF TRANSISTOR AMPLIFIERS. K.P.P.Nambiar.
J. Instn Telecomm. Engrs (New Dehli), Vol. 5, No. 3, 152-62 (June, 1959).

Basic forms of equivalent circuits of transistors are first discussed followed by descriptions of biasing techniques. Based on these considerations methods of design are outlined for audio and high-frequency amplifying stages and the effect of parameter variation at the higher frequencies are mentioned briefly, together with techniques for minimising the effects of these variations. The application of a.g.c. in transistor circuits is also dealth with. J.MacCormack

621.375.4

2970 SINGLE OC26 IN CAR-RADIO OUTPUT STAGES.
Mullard tech. Commun., Vol. 5, 74-8 (Feb., 1960).

Two car-radio output stages are described, one for an OC26 output transistor driven by a valve (EF98), the other for an OC26 driven by a transistor (OC71). The output power for the valve-driver circuit is 3.3W into the primary of the output transformer, at about 10% total-harmonic distortion. For the transistor-driver circuit, the corresponding output power is 3 W at about 3% total-harmonic distortion.

621.375.4

2971 TEMPERATURE STABILISATION OF TRANSISTORS IN CLASS B AMPLIFIERS. K.L.Webber.
Proc. Instn Radio Engrs Australia, Vol. 20, No. 12, 726-33 (Dec., 1959).

Factors affecting the stability are discussed, with emphasis on those which are important and/or are peculiar to the class B circuit. Mention is also made of the methods of obtaining temperature stabilization, including non-linear compensation. Finally, some experimental correlation with theoretical consideration is made.

621.375.4

2972 LINEAR AMPLIFIERS USING TRANSISTORS.
R.Forshufvud and P.O.Leine.
Tekn, T., Vol. 90, No. 5, 93-111 (Jan. 29, 1960). In Swedish.

Base input to the transistor, the types of coupling and the use of feedback to achieve linearity in amplification are explained. Operation of the transistor under class A, B and D conditions is dealt with, class C being identical with that of the electron tube. The effect of temperature on operating characteristics is studied in some detail, curves being shown of collector/base current characteristics at temperarures between +20 and −70°C. Thermal stability (runaway), stabilization of the operating point and of amplification are also dealt with. Sections are given on the use of transistors in d.c. amplification, noise, frequency limits, measurement methods and on the interpretation of data charts, these, particularly American, often 'ving difficulty. G.N.J.Beck

621.375.422

2973 JUNCTION TRANSISTOR CIRCUITS. CALCULATION OF TEMPERATURE DRIFT. J.J.Ward.
Electronic Technol., Vol. 37, No. 3, 109-15 (March, 1960).

Presents a method of calculating current drift due to changes of junction temperature in a direct-coupled transistor circuit with series negative feedback. A brief comparison between this circuit using parallel feedback is made. Although only a limited number of configurations are analysed, the treatment is in general terms which are applicable to a large number of other arrangements. The information derived should enable the design of drift-compensating circuits to be undertaken by less empirical means than are usually adopted; some methods of drift cancellation which suggest themselves from the analysis are discussed. A design example is given, together with results obtained from measurements on a practical circuit using silicon transistors.

621.375.5

2974 INVESTIGATION OF OPERATING CONDITIONS OF A DIELECTRIC RESONANT AMPLIFIER.
T.Krajewski, J.Pietrzak and J.Suwalski.
Acta phys. Polon., Vol. 16, No. 5, 389-95 (1957).

The operating conditions of a dielectric resonant amplifier and the dielectric properties of $(Ba-Sr)TiO_3$ ferroelectric capacitors employed in the amplifier, are investigated. Curves of the relative permittivity variation v. the d.c. field at various temperatures were obtained. The following characteristics of the dielectric amplifier under investigation were measured: output voltage v. signal voltage and signal frequency; and voltage-amplification coefficient v. temperature. The largest voltage-amplification value was obtained within the Curie point region. The temperature being constant, this amplification value remained practically constant over the entire audio-frequency range. The measurements proved that it is possible to determine the optimal operating conditions of the dielectric amplifier from the graphs showing the dependence of the permittivity of the ferroelectric material on the d.c. field and on the temperature.

621.375.9

2975 A TUNABLE X-BAND RUBY MASER. P.D.Gianino and F.J.Dominick.

Proc. Inst. Radio Engrs, Vol. 48, No. 2, 260 (Feb., 1960).

A continuous tuning range of 205 Mc/s with constant gain (20dB) and bandwidth (10Mc/s) was achieved using a 0.5% chromium-doped ruby crystal. The crystal almost completely filled a rectangular cavity in which a single plunger tuned both the signal and pump frequencies. The maser is pumped utilizing the "push-pull" double pumping principle at a bath temperature between 1.35° and 1.5°K with ~60 mW c.w. power. A.P.C.Thiele

621.375.9 : 538.56

2976 SUBMILLIMETER WAVE MASER. S.M.Bergmann.

J. appl. Phys., Vol. 31, No. 2, 275-6 (Feb., 1960).

It is shown that coherent emission between the levels $3^2P_{\frac{3}{2}}-3^2P_{\frac{1}{2}}$ for Na atoms enclosed in a resonant cavity should occur at a rate greater than in free space where transition probabilities are very low. It is therefore proposed to operate a maser at the submillimetre wavelengths corresponding to these transitions ($\nu = 5.18 \times 10^{11}\text{sec}^{-1}$) using a dielectric tube resonator as the cavity. An input and output coupling scheme is discussed.

621.375.9

2977 FLUCTUATION ACTION IN THE SIMPLEST PARAMETRIC SYSTEMS. V.I.Tichonov.

Avtomat. i. Telemekh., Vol. 19, No. 8, 717-24 (1958). In Russian. English summary: PB 141096T-7, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

Statistical characteristics of the output random signal of a parametric system are obtained when external action and the variable element are correlated stationary normal random functions. The system under consideration is described by the first-order linear differential equation.

621.375.9

2978 THE PARAMETRIC AMPLIFIER. I. C.R.Russell.

Brit. Commun. and Electronics, Vol. 7, No. 2, 94-8 (Feb., 1960).

The mechanism of these devices is first explained in fairly simple terms. A review is then made of present state of the art and the different types of semiconductor-diode and ferrite-type amplifiers that have been proposed and constructed.

621.375.9

2979 THE PARAMETRIC AMPLIFIER. II. C.R.Russell.

Brit. Commun. and Electronics, Vol. 7, No. 3, 190-4 (March, 1960).

A review of the main features of beam parametric amplifiers of the longitudinal space-charge wave and the transverse-field type. Some general comments on noise figure measurements on parametric amplifiers are also given.

621.375.9 : 538.56

2980 CONCERNING THE TRANSMISSION OF SIGNALS OF ANY FORM WITH THE AID OF A DEGENERATE PARAMETRIC AMPLIFIER. F.Bertein and A.Jelenski.

C.R. Acad. Sci. (Paris), Vol. 250, No. 1, 88-90 (Jan. 4, 1960). In French.

A condensed introduction to a general analysis of diode parametric amplifiers is presented. S.A.Ahern

621.375.9 : 538.56

2981 THEORY OF FAST-WAVE PARAMETRIC AMPLIFICATION. C.C.Johnson.

J. appl. Phys., Vol. 31, No. 2, 338-45 (Feb., 1960).

A new type of low-noise beam-type parametric amplifier has recently been introduced by Adler, Hrbek, and Wade (See Abstr. 1646 of 1959). This device is characterized by its use of the fast-cyclotron wave for amplification purposes instead of the conventionally used slow space-charge wave. The fast-cyclotron wave is selected because it can be made relatively noiseless by appropriate coupling processes. Since the input beam noise is the principal source of noise in beam-type tubes, a very great reduction in noise figure is obtained. Amplification of the fast-cyclotron wave is achieved by use of the parametric principle. An analytical description of the device is presented which includes a discussion of parametric amplification of the fast-cyclotron wave. A method of coupling to cyclotron waves is investigated, and design procedures for establishing optimum low-noise characteristics are outlined.

621.375.9 : 538.56

2982 PARAMETRIC AMPLIFICATION. K.W.H.Stevens.

J. sci. Instrum., Vol. 37, No. 1, 1-5 (Jan., 1960).

A review of the underlying ideas of parametric amplification. The discussion is mainly in physical terms and passes from simple circuit amplifiers to the more complex Suhl-types of amplifier. Mention is made of some of the directions in which research is proceeding.

621.375.9

2983 EXPERIMENTAL VERIFICATION OF PARAMETRIC AMPLIFIER EXCESS NOISE USING TRANSFORMER COUPLING. S.Cohen.

Proc. Inst. Radio Engrs, Vol. 48, No. 1, 108-9 (Jan., 1960).

By using a transformer to couple a parametric amplifier to a second stage, it has been found that with suitable adjustment of the transformer turns-ratio and the negative conductance of the amplifier it is possible to minimize the noise contributed by the second stage. A method is thus provided whereby effective noise temperature of parametric amplifiers can be measured — the method being of particular use when the amplifiers operate in regions where circulators are not available. G.D.Sims

621.375.9

2984 NOISE CONSIDERATION OF THE VARIABLE CAPACITANCE PARAMETRIC AMPLIFIER. M.Uenohara.

Proc. Inst. Radio Engrs, Vol. 48, No. 2, 169-79 (Feb., 1960).

Describes a model of the variable capacitance diode in which the spreading resistance is considered as the source of amplifier noise. Gain and noise figure calculations are made for this model and experimental results obtained at 5.84 kMc/s while pumping at 11.7 kMc/s are presented for gallium arsenide, silicon and germanium diodes. The quantity $1/\omega C_o R_s$ is defined as a "quality factor" where R_s is the spreading resistance and C_o is the static capacitance at zero bias point. Computations of minimum noise figure, optimum pumping factor, are all given in terms of the parameter $\omega C_o R_s$. The essential differences between single- and double-sideband reception are discussed. Over a range of sufficiently large values of the parameter $\omega C_o R_s$, there is a reasonable correlation of the theory developed with the measurements performed on most of the diodes. In the range of relatively small values of $\omega C_o R_s$, the model proves inadequate to describe some diodes properly and suggests the need for introducing extra noise sources. These noise sources are also discussed. Of the experimental data obtained thus far, the best result has been with a gallium arsenide diode which yields a 0.9 dB double-sideband noise figure and, equivalently, 3.9 dB for single-sideband operation with 16 dB gain and 25 Mc/s of single-sideband frequency bandwidth.

621.375.9 : 621.396.96

2985 NOISE TEMPERATURE IN A RADAR SYSTEM. H.H.Grimm.

Proc. Inst. Radio Engrs, Vol. 48, No. 2, 246-7 (Feb., 1960).

Describes experiments in which parametric amplifiers were used as pre-amplifiers in an L-band radar system. In one case, used as an inverting up-converter, the excess temperature contributed by the amplifier and succeeding components of the receiver was only 140°K, compared with 190°K for the aerial–duplexer–transmission line system. G.D.Sims

621.375.9

2986 PRACTICAL APPLICATION OF THE PARAMETRIC AMPLIFIER. W.Roeck.

Schweiz. tech. Z. (S.T.Z.), Vol. 57, No. 5, 81-8 (Feb. 4, 1960).

A review of parametric amplifiers using semiconductor diodes as the variable-reactance element.

621.375.9

2987 GENERAL ASPECTS OF BEATING-WAVE AMPLIFICATION. W.G.Dow and J.E.Rowe.

Proc. Inst. Radio Engrs, Vol. 48, No. 1, 115 (Jan., 1960).

Discussion of possible narow and broad-band applications of the phenomenon of beating between space-charge waves of differing phase velocities on a double beam. Amplification is achieved, as described by Rowe (Abstr. 4260 of 1959), not by means of a growing wave but by having input at the node and output at the antinode of the standing-wave pattern. B.Meltzer

621.375.9

2988 FERROMAGNETIC AMPLIFIERS. A.F.H.Thomson.

Proc. Inst. Radio Engrs, Vol. 48, No. 2, 259 (Feb., 1960).

When a magnetized yttrium iron garnet sphere is placed in a microwave field whose H-component is parallel to the axis of magnetization, an absorption of power is found to take place when the microwave frequency is equal to twice that corresponding to the magnetization field, provided that the r.f. field exceeds a certain threshold value. It is thought that this arises as a result of parametric excitation of pairs of spin wave modes of the material. G.D.Sims

621.375.9 : 621.382 : 538.56

GRAIN-BOUNDARY AMPLIFIER. See Abstr. 3007

MODULATION . DEMODULATION

621.376 : 621.396.61

2989 THE COMPUTATION OF SINGLE-SIDEBAND PEAK POWER. W.K.Squires and E.Bedrosian.

Proc. Inst. Radio Engrs, Vol. 48, No. 1, 123-4 (Jan., 1960).

An analysis of the average and peak power of a.m., d.s.b. and s.s.b. amplitude-modulated techniques is offered, with emphasis on nearly rectangular waveforms (clipped speech, pulse-code data, etc.). The modulatory signal is represented by the periodic function $\sin^{\nu}x$; with $\nu = 1$ the waveform is sinusoidal, with $\nu \to 0$ it is square. The s.s.b. average power is equal to the modulating signal average power. The s.s.b. peak power is computed by Fourier analysis, the integration and summation being carried out in a special order, and the derived formulae are discussed and interpreted. The results show that for small values of ν, i.e. waveform approximately square, the s.s.b. average-to-peak-power ratio $\to \nu^2$; hence for applications with even moderately rectangular waveforms s.s.b. is inferior to a.m. and d.s.b. A.Landman

621.376.22 : 621.375.222

2990 INPUT CIRCUITS OF CONTACT-MODULATED AMPLIFIERS. D.E Polonnikov.

Avtomat. i Telemekh., Vol. 19, No. 6, 582-91 (1958). In Russian. English summary: PB 141096T-5, obtainable from Office of Technical Services, U.S.Dept. of Commerce, Washington, D.C., U.S.A.

The main requirements of input circuits for amplifiers in automatic potentiometers are discussed. A table of input circuit diagrams using contact-modulation is given, and formulae for obtaining the parameters of the circuits in question are deduced.

621.376.22 : 621.375.2.024

2991 CONSIDERATIONS ON A MODULATOR FOR D.C. AMPLIFIERS. L.Dadda.

Ricerca. sci., Vol. 29, No. 8, 1676-86 (Aug., 1959). In Italian.

The modulator is of the chopper type with a difference amplifier, in which the effect of grid current is eliminated by capacitor coupling. The circuit is analysed and the criteria for an ideal step response are studied. W.G.Stripp

621.376.22

2992 A TRANSISTOR CHOPPER FOR [D.C.] MEASUREMENTS. A.Billoti.

Radio Mentor, Vol. 25, No. 10, 792-7 (Oct., 1959). In German.

Gives useful analyses, with numerical examples, of the characteristics of various chopper circuits, mostly using one, or a pair of, OC70 type transistors driven from a 50 c/s mains waveform. F.F.Roberts

621.376.22

2993 MODULATORS FOR CONVERSION OF VERY SMALL D.C.POTENTIALS INTO A.C. G. Meyer-Brötz.

Telefunken Ztg, Vol. 32, 189-95 (Sept., 1959). In German.

A technical survey of all existing modulators (d.c.choppers) for d.c. amplifier–convertors is presented, briefly treating the principle of operation and obtainable sensitivity and stability of each type. Th These are: mechanical vibrator, variable capacitor, photoresistive cell, superconducting modulator (thallium wire immersed in liquid helium and magnetically modulated), diode modulator (usually bridge circuit), transistor chopper, moving-coil galvanometer and saturated magnetic modulator. Input resistance, drift voltage and current, lowest input power, operating frequency range and carrier power required are compared in a table. A bibliography of 32 references is appended. A.Landman

621.376.222 : 621.383.4

2994 A TRANSISTOR PHOTOELECTRIC CHOPPER FOR D.C. OPERATIONAL AMPLIFIERS. E.V.Dobrov.

Priborostroenie, 1959, No. 2 (Feb.). In Russian. English translation in: Instrum. Constr., 1959, No. 2, 13-17 (Feb.).

Two circuits, using either one or two lead sulphide photocells are described, with a fairly comprehensive theoretical and experimental analysis of their performance. Use is made of the change in ohmic resistance of the cell when light is present or not. Cells have been produced which only develop a photo e.m.f. of about 200μV maximum. Better production methods may reduce this figure still further. Excitation is by means of a slotted disk driven by a synchronous motor. An experimental transistor d.c. amplifier incorporating the drift-correcting chopper is also described. Input impedance to the chopper circuit is 300-400 kΩ. Drift of chopper is ~ 20μV. K.C.Garner

621.376.223

2995 MODULATION OF DIRECT CURRENTS BY A RING MODULATOR. J.L.Leroy and C.Mabboux.

J. Phys. Radium, Vol. 18, Suppl. No. 7, 106A-107A (July, 1957). In French.

The modulation of direct currents, before their amplification, may be made by a ring modulator using crystal rectifiers. The carrier leak is considerably reduced by balancing the modulator so that it is possible to modulate input signals of 0.1 mV at low impedance (500 ohms).

621.376.23 : 537.7

2996 A CONDENSER MEMORY UNIT FOR IMPROVING SIGNAL-TO-NOISE RATIOS. D.M.Hunten.

Canad. J. Phys., Vol. 38, No. 3, 346-53 (March, 1960).

The unit contains 30 low-leakage capacitors which can store a signal for several hours if necessary. If the signal is repeated over and over, the successive scans can be added in and the signal-to-noise ratio builds up as the square root of the number of repetitions. In principle, the final signal-to-noise ratio is only slightly better than would be obtained from a single scan stretched out to fill the same total time, but in practice the result may be considerably better, especially if the signal fluctuates slowly. It has been used successfully in several investigations of twilight spectra with photoelectric and photoconductive spectrometers. The original version took 1 minute per scan and was rather bulky; a recent modification can scan 32 channels in 10 seconds if required.

621.376.3

2997 EXPLICIT FORM OF F.M. DISTORTION PRODUCTS WITH WHITE-NOISE MODULATION. R.G.Medhurst.

Proc. Instn Elect. Engrs, Monogr. 352E, publ. Jan., 1960. (Vol. 107C, 120-6).

Republication of the monograph abstracted in Abstr. 866 (1960).

621.376.3

2998 THE CALCULATION OF STATIC AND DYNAMIC AMPLITUDE- AND FREQUENCY DISTORTION OF FREQUENCY-MODULATED WAVEFORMS BY EXPRESSING THE TRANSFER FUNCTION IN SERIES FORM. E.G.Woschni.
Wiss. Z. Hochsch. Maschinenbau Karl-Marx-Stadt, Vol. 1, No. 2, 51-7 (1958-59). In German.

It is pointed out that the various types of distortion which occur with f.m. signals are all determined by a knowledge of the complex transfer function for all significant frequencies. A method of computation is described using a Taylor-series expansion of which only a limited number of terms are retained. V.G.Welsby

621.376.322

2999 A NEW WIDEBAND DISCRIMATOR. N.B.Chakraborti.
Indian J. Phys., Vol. 32, No. 12, 537-46 (Dec., 1958).

Describes a discriminator, employing transmission lines, designed to have linear response over a wide range of frequency deviation. It is shown that linearity of response can be obtained without difficulty up to a fractional frequency deviation as high as 50%.

621.376.52

3000 ON THE MODULATION OF DIRECT CURRENTS BY A TRANSISTOR SWITCH. J.L.Leroy and C.Mabboux.
J. Phys. Radium, Vol. 18, Suppl. No. 12, 135A-136A (Dec., 1957). In French.

A two-transistor switch can modulate, before amplification, direct or slowly-variable signals down to a few microvolts into an input impedance of 30 ohms; the carrier is supplied by a transistor-multivibrator operating from a 4.5 V battery.

ELECTRONICS

SEMICONDUCTOR MATERIALS AND DEVICES

TRANSISTORS

621.382 : 621.315.59 : 539.2 : 537.311

3001 SEMICONDUCTORS AND PHOSPHORS [HALBLEITER AND PHOSPHORE].
Brunswick: Vieweg (1958) 684 pp.

For abstracts of some of the papers read at the above Conference at Garmish (1958) see Abstr. 5068-9, 5194, 5392, 6304, 6327, 6627, 7422, 7424 (1959).

621.382

3002 GERMANIUM AND SILICON. T.R.Scott.
Proc. Instn Elect Engrs, Paper 3084 E [Lecture delivered at the International Convention on Transistors and Associated Semiconductor Devices] Vol. 106B, Suppl. 17, 843-6, 883-4 (1959).

The problems associated with the specification, assessment and control of degree of purity and of crystal perfection of germanium and silicon, used for transistor and diode manufacture, are discussed in terms of current practice. J.B.Birks

621.382

3003 THE USE OF ETCHANTS IN ASSESMENT OF SEMICONDUCTOR CRYSTAL PROPERTIES. P.J.Holmes.
Proc.Instn Elect. Engrs Paper 2941 E, publ. May, 1959 [International Convention on Transistors and Associated Semiconductor Devices] Vol. 106 B, Suppl. 17, 861-5, 883-4 (1959).

Republication, with discussion, of the paper abstracted in Abstr. 2691 (1959).

621.382

3004 SOME PROPERTIES AND APPLICATIONS OF SPACE-CHARGE-LIMITED CURRENTS IN INSULATING CRYSTALS. G.T.Wright.
Proc. Instn Elect. Engrs, Paper 2928 E, publ. May, 1959 [International Convention on Transistors and Associated Semiconductor Devices] Vol. 106B, Suppl. 17, 915-22, 937-8 (1959).

Republication, with discussion, of the paper abstracted in Abstr. 2693 (1959).

621.382

3005 SOLID-STATE DIELECTRIC CIRCUIT DEVICES. G.T.Wright.
Electronics, Vol. 33, No. 9, 59-61 (Feb. 26, 1960).

Describes the practical potentialities of diodes and triodes made using the principle of space-charge-limited currents in insulators such as cadmium sulphide. C.A.Hogarth

621.382

3006 CHARACTERIZATION AND PROPERTIES OF DEVICES. J.J.Ebers.
Proc. Instn Elect. Engrs, Paper 3126 E [International Convention on Transistors and Associated Semiconductor Devices] Vol. 106 B, Suppl. 17, 939-41, 1009-11 (1959).

The stored-charge equivalent circuit approach to semiconductor devices is briefly outlined. The frequency limitations of such devices are discussed with particular reference to a mesa-type diffused-base germanium transistor, and to the potentialities of variable-capacitance ("varactor") microwave diodes and the Esaki diode. J.B.Birks

621.382 : 621.375.9 : 538.56

3007 THE GRAIN-BOUNDARY AMPLIFIER. O.A.Weinreich, H.Matare and B.Reed.
Proc. Phys. Soc., Vol. 73, Pt 6, 969-72 (June, 1959).

Describes how the sheet conductance at a grain boundary in a semiconductor can be modulated by an electric field, leading to amplification. It is shown that the low-temperature limit for this amplifier is practically unlimited; but the upper limit is probably similar to that for other semiconductor devices involving junctions. Measurements have been made on n-type germanium samples. These have input resistance of approximately 10^5 Ω at room temperature, increasing to approximately 10^7 Ω at low temperatures. At 78°K and 4.2°K the power amplification was 21 dB and 23 dB respectively at 1 kc/s, dropping to half at 10 kc/s and approaching zero at 50 kc/s. S.A.Ahern

621.382 : 539.2 : 537.311

3008 THE PIEZORESISTIVE EFFECT AND ITS APPLICATIONS. L.E.Hollander, G.L.Vick and T.J.Diesel.
Rev. sci. Instrum., Vol. 31, No. 3, 323-7 (March, 1960).

Piezoresistivity, the change in resistivity with applied stress, offers a tool for analysing the conduction mechanism in semiconductors and also offers potential transducer applications. A discussion of this effect in semiconductors and an analysis of the fourth-rank piezoresistive tensor for two crystal symmetries are presented. The magnitude of the effect in semiconductors is tabulated, including two materials, TiO_2 and PbTe, which the authors have determined to be of considerable interest. The design of devices based on piezoresistivity is discussed and illustrated by working models.

621.382.2

3009 TECHNIQUE FOR MAKING CRACK-FREE ALLOYED JUNCTIONS IN SILICON. T.C.Taylor.
I.R.E. Trans Electron Devices, Vol. ED-6, No. 3, 358-9 (July, 1959).

It has been noted that certain pure metals, when fused or alloyed to silicon, will produce cracks in the silicon on solidifying, due to the difference in coefficients of thermal expansion of the resulting alloys and the silicon. A method of alloying which avoids this cracking consists of fusing the metal to the semiconductor at a temperature which may closely approach the melting point of silicon and which, it is claimed, forms an alloy which is mechanically compatible with the semiconductor. J.MacCormack

621.382 : 539.2 : 537.311

3010 ION DRIFT IN AN N–P JUNCTION. E.M.Pell.
J. appl. Phys., Vol. 31, No. 2, 291-302 (Feb., 1960).

If a reverse bias is applied to an n–p junction at a sufficiently elevated temperature to give either the donor or the acceptor ions appreciable mobility, the ions will drift in the electric field of the junction to produce an intrinsic semiconductor region between the n and p regions. Such ion drift offers a simple and straightforward method for investigating diffusion constants, as well as chemical interactions within the host lattice which affect this diffusion. Preliminary results indicate its feasibility for measuring the diffusion constant of Li in Si to as low as 10^{-13} cm^2/sec and also for measuring the effect of Li–oxygen and Li–acceptor interactions in decreasing the diffusion rate. Intrinsic regions resulting from ion drift have been used to produce diodes with breakdown in excess of 4000 V from low resistivity silicon. In addition, they can be used to extend the frequency range of devices by virtue of the decrease in junction capacitance associated with such an incorporated intrinsic region. Ion drift has also been used for the fabrication of analogue transistors, an early unit having an input impedance of 6 megohms, a power gain of 17 dB and a voltage gain of 4.

621.382.2 : 539.2 : 537.311

3011 P–N JUNCTIONS AT LOW TEMPERATURES. B.M.Vul.

Dokl. Akad. Nauk SSSR, Vol. 129, No. 1, 61-3 (Nov. 1, 1959). In Russian.

The space-charge equations at a p–n junction are investigated, using a number of approximations, valid, at low temperatures, for junctions at which the impurity concentrations change discontinuously between uniform values. The step in potential is found to be largely confined to the less heavily doped material, and is equal in magnitude to the gap-width expressed in electron-volts. The differential capacitance is constant, and equal to the value attained at temperatures high enough for complete ionization of the impurities. The calculations are supported by capacitance measurements (see following abstract). I.D.C.Gurney

621.382.2 : 539.2 : 537.311

3012 CAPACITANCE OF P–N JUNCTIONS AT LOW TEMPERATURES. B.M.Vul and É.I.Zavaritskaya.

Zh. eksper. teor. Fiz., Vol. 38, No. 1, 10-17 (Jan., 1960). In Russian.

Capacitance of p–n junctions in germanium and silicon was measured down to liquid-helium temperatures. At very low temperatures the junction capacitance could not be measured because of the small series capacitance of the base between the junction and the electrodes. The observed effects can be explained by means of a simple equivalent circuit. The screening effect of an inversion layer in the space-charge region and the contact potential are also discussed. A.Tybulewicz

621.382.2

3013 ZENER DIODES — THEIR PROPERTIES AND APPLICATIONS. J.M.Waddell and D.R.Coleman.

Wireless Wld, Vol. 66, No. 1, 17-21 (Jan., 1960).

The characteristics of these components, including temperature coefficients, are explained and brief reference is made to the physical processes involved. In particular, the difference between the true Zener effect (at low breakdown voltages) and the avalanche-multiplication effect (at high breakdown voltages) is stressed. The many possible applications, such as voltage regulation, operation as voltage-reference sources, surge limiting, waveform clipping and decoupling, are briefly reviewed. The capacitance of the Zener diode, which is dependent upon voltage, can be used for a.f.c. purposes and the like. H.G.M.Spratt

621.382.23

3014 THE CHARACTERISTICS AND APPLICATIONS OF ZENER (VOLTAGE REFERENCE) DIODES. J.A.Chandler.

Electronic Engng, Vol. 32, 78-86 (Feb., 1960).

Detailed characteristics of Zener diodes are presented and curves are given showing the variation of a.c. and d.c. slope resistance with both current and voltage, breakdown voltage variation with temperature, and the forward characteristics of the diodes. The general circuit of the simple stabilized supply is considered, with the limitations due to diode and circuit limits. Temperature compensation of the diodes is considered and results shown. Stability of output voltage with input and load variations is given in detail using the characteristics already mentioned. The two-stage stabilizer is considered and a practical example of a high-stability reference is given. The results show that a very high stability reference can be constructed using relatively simple circuits.

621.382.23

3015 THE DESIGN AND PERFORMANCE OF A HIGH-SPEED SILICON DIODE. M.J.Calle, B.Dale and C.A.P.Foxell.

Proc. Instn Elect. Engrs, Paper 2910 E, publ. May, 1959. [International Convention on Transistors and Associated Semiconductor Devices] Vol. 106B, Suppl. 17, 1138-45, 1153-4 (1959).

Republication, with discussion, of the paper already abstracted in Abstr. 3002 (1959).

621.382.2

3016 TEMPORARY AND PERMANENT DETERIORATION OF MICROWAVE SILICON CRYSTAL DIODES. P.P.Lombardini and R.J.Doviak.

Proc. Inst. Radio Engrs., Vol. 48, No. 1, 119-20 (Jan., 1960).

Briefly summarizes some findings, using local-oscillator rectified current as the main indication of deterioration or recovery. F.F.Roberts

621.382.2 : 537.311 : 539.2

3017 PRESSURE DEPENDENCE OF THE CURRENT–VOLTAGE CHARACTERISTICS OF ESAKI DIODES. S.L.Miller, M.I.Nathan and A.C.Smith.

Phys. Rev. Letters, Vol. 4, No. 2, 60-2 (Jan. 15, 1960).

The log of the peak current is found to fall nearly linearly with pressure. After determining the dependence of the energy gap on pressure over the same range (0-30 000 kg/cm^2), it is deduced that the results are consistent with existing theories of the tunnel diode. K.W.Plessner

621.382.23 : 621.319.43

SILICON JUNCTION VARIABLE-CAPACITANCE DIODES: L.F. CHARACTERISTICS. See Abstr. 2864

621.382.3

3018 SELECTING TRANSISTORS FOR RADIATION ENVIRONMENT. J.R.Bilinski and R.Merrill.

Electronics, Vol. 32, No. 52, 38-40 (Dec. 25, 1959).

The lifetime of minority carriers during irradiation is expressed as:

$$\frac{1}{\tau_F} = \frac{1}{\tau_1} + \frac{\phi}{K}$$

where τ_1 is the normal lifetime in the absence of irradiation, ϕ is the integrated neutron flux and K is an empirical lifetime damage constant. Since the current gain β depends on the lifetime of minority carriers in the base region it is possible to show that the ratio of current gains before and after irradiation is given by:

$$\frac{\beta_F}{\beta_1} = \frac{1}{1 + \left(\frac{1.22}{2\pi}\right)\left(\frac{\phi\beta_1}{Kf_{\alpha co}}\right)}$$

Nomograms are provided based on this equation for n-p-n, p-n-p germanium and silicon transistors. The effect of irradiation on collector leakage current is hardly mentioned. J.MacCormack

621.382.3

3019 DETERMINATION OF THE THERMAL IMPEDANCE OF GERMANIUM TRANSISTORS. G.P.Leroux.

Proc. Instn Elect. Engrs, Paper 3128 E [International Convention on Transistors and Associated Semiconductor Devices, May, 1959], Vol. 106B, Suppl. 17, 1146-9, 1153-4 (1959).

Heat dissipation presents a major problem to an engineer designing power transistors. The best way of characterizing a transistor is by quoting the thermal impedance between the collector junction and the stud. This impedance can be analysed into a few elementary impedances, which it is possible to calculate and measure, although the calculation, of which two examples are given, can be only a rough approximation. A method of checking these calculations is developed which can lead to the improvement of the design under consideration.

621.382.3

3020 TRENDS IN TRANSISTOR MANUFACTURING TECHNIQUES. A.E.Anderson.

Proc. Instn Elect. Engrs, Paper 3110 E [International Convention on Transistors and Associated Semiconductor Devices, May, 1959] Vol. 106B, Suppl. 17, 1160-2, 1181 (1959).

621.382.3 : 621-52 : 621.317.39

AUTOMATIC MEASUREMENT OF THICKNESS AS APPLIED TO GERMANIUM WAFER PRODUCTION IN TRANSISTOR MANUFACTURE. See Abstr. 2820

621.382.3 : 621.374.32

TRANSISTOR BIAS METHOD RAISES BREAKDOWN POINT. See Abstr. 2947

621.382.332.3

3021 MECHANIZATION FOR PRODUCTION OF HIGH-FREQUENCY ELECTROCHEMICAL TRANSISTORS.
S.L.Parsons.
Proc. Instn Elect. Engrs, Paper 3111 E [International Convention on Transistors and Associated Semiconductor Devices, May, 1959], Vol. 106B, Suppl. 17, 1163-7, 1181 (1959).

A detailed account is given of the techniques developed for the automatic production of high-frequency surface-barrier transistors by electrochemical jet etching and plating. The mechanical and infrared transmission methods used for precise thickness control in the jet-etching process are described. A fully automatic machine has been developed for the subsequent operations of attaching emitter and collector leads, clean-up etching the surface, and washing and drying the transistors, prior to baking and encapsulation.

J.B.Birks

621.382.333

3022 SURVEY OF PRESENT-DAY MANUFACTURING TECHNIQUES OF TRANSISTORS. J.M.Mercier.
Proc. Instn Elect. Engrs, Paper 3109E. [International Convention on Transistors and Associated Semiconductor Devices, May, 1959] Vol. 106B, Suppl. 17, 1155-9, 1181 (1959).

The 19 principal types of p-n-p and n-p-n transistors are classified into four main groups of manufacturing techniques : alloy junctions, grown junctions, diffused junctions, and special processes (e.g. surface-barrier) or combination of several processes. Flow charts are given for each of the first three groups, and the steps involved in device fabrication — material preparation, junction formation, mounting and contacting, etching and encapsulation — are briefly surveyed. J.B.Birks

621.382.333

3023 AN INVESTIGATION OF THE ALLOYING TECHNIQUE FOR THE FABRICATION OF GERMANIUM P–N–P TRANSISTORS. R.E.Warren and H.Yemm.
Proc. Instn Elect. Engrs, Paper 2906 E, publ. May, 1959 [International Convention on Transistors and Associated Semiconductor Devices] Vol. 106B, Suppl. 17, 1176-80, 1181 (1959).

Republication, with discussion, of the paper already abstracted in Abstr. 3015 (1959).

621.382.333

3024 AUXILIARY MATERIALS IN TRANSISTOR TECHNOLOGY. W.C.Dunlap.
Proc. Instn Elect. Engrs, Paper 3085 E [Lecture delivered at the International Convention on Transistors and Associated Semiconductor Devices] Vol. 106B, Suppl. 17, 847-9, 883-4 (1959).

The materials considered are those used to modify the properties of the primary semiconductor. The relevant properties of the materials used for doping, alloying and diffusion are described and discussed. J.B.Birks

621.382.333

3025 NOISE IN GERMANIUM AND SILICON TRANSISTORS IN THE HIGH CURRENT RANGE.
B.Schneider and M.J O.Strutt.
Arch. elekt. Übertragung, Vol. 13, No. 12, 495-502 (Dec., 1959).
In German.

The inductive component, found by other workers in p–n junctions carrying high forward currents, is shown to account also for the detailed shape of the alpha v. frequency characteristics of a transistor at high emitter currents. The corresponding more elaborate equivalent circuit is shown to account for the detailed shape of the noise v. frequency characteristic in the neighbourhood of the alpha cut-off frequency. F.F.Roberts

621.382.333

3026 LIFE-TESTING OF GERMANIUM POWER TRANSISTORS.
B.J.Cooper and R.B.Ireland.
Brit. Commun. and Electronics, Vol. 7, No. 1, 14-20 (Jan., 1960).

A simple procedure is established which enables those transistors which are inherently unreliable to be detected and rejected.

621.382.333

3027 TRANSISTOR OPERATION AIDED BY THERMO-ELECTRIC REFRIGERATION.
H.J.Goldsmid and R.A.Hilbourne.
Brit. Commun. and Electronics, Vol. 7, No. 1, 26-30 (Jan., 1960).

The factors which must be considered in designing thermo-electric devices for the cooling of transistors are discussed.

P.M.Davidson

621.382.333

3028 ON THE FREQUENCY DEPENDENCE OF THE MAGNITUDE OF COMMON-EMITTER CURRENT GAIN OF GRADED-BASE TRANSISTORS. M.B.Das and A.R.Boothroyd.
Proc. Inst. Radio Engrs, Vol. 48, No. 2, 240-1 (Feb., 1960).

The exact theoretical common-emitter current gain with neglect of the effect of emitter depletion-layer capacitance is found to fall with frequency at about 6 dB/octave over a wider frequency range than indicated by the approximate expression derived. But at very high frequencies the slope becomes much greater than 6dB/octave. If however the base charging time-constant and the emitter depletion capacitance–emitter resistance time-constant are comparable the slope departs from 6dB/octave even at quite low frequencies.

F.F.Roberts

621.382.333

3029 FUNDAMENTALS OF JUNCTION TRANSISTORS.
G. King.
Proc. Instn Elect. Engrs, Paper 3122 E [Lecture delivered at the International Convention on Transistors and Associated Semiconductor Devices] Vol. 106B, 885-6, 937-8 (1959).

Junction transistors are discussed from a production engineering standpoint. Developments over recent years are considered in terms of the increased number of design features available and the feasibility of their control in production. J.B.Birks

621.382.333

3030 THE FACTORS THAT DETERMINE THE HIGH-FREQUENCY PERFORMANCE OF TRANSISTORS.
J.R.A.Beale.
Proc. Instn Elect. Engrs, Paper 3123E [International Convention on Transistors and Associated Semiconductor Devices] Vol. 106B, Suppl. 17, 903-5, 937-8 (1959).

The high-frequency behaviour of a transistor model of idealized geometry is analysed in terms of an approximate lumped equivalent circuit, derived from the distributed equivalent circuit. The general factors determining h.f. performance are discussed.

J.B.Birks

621.382.333

3031 APPROXIMATION TO α FOR DIFFUSION TRANSISTORS. R.S.C.Cobbold and D.A.Goodings.
Proc. Instn Elect. Engrs, Paper 2976 E, publ. May, 1959 [International Convention on Transistors and Associated Semiconductor Devices] Vol. 106B, Suppl. 17, 1018-25, 1072-4 (1959).

Republication, with discussion, of the paper abstracted in Abstr.3692 (1959).

621.382.333

3032 SURFACE-IMMUNE TRANSISTOR STRUCTURE.
H.Nelson.
Proc. Instn Elect. Engrs, Paper 2870 E, publ. May, 1959 [International Convention on Transistors and Associated Semiconductor Devices] Vol. 106B, Suppl. 17, 1150-2,1153-4 (1959).

Republication, with discussion, of the paper already abstracted in Abstr. 2349 (1959).

621.382.333

3033 TRANSISTOR CIRCUIT DESIGN USING MODIFIED HYBRID PARAMETERS. R.E.Aitchison.
Proc. Instn Radio Engrs Australia, Vol. 20, No. 11, 873-9 (Nov., 1959).

By the use of modified hybrid parameters the normal expressions for transistor amplifier characteristics can be extended to special cases where the circuit is modified by shunt, series, or common impedances in the circuit. Methods are given for the calculation of such modified hybrid parameters, and of the approximate expressions which are applicable for the various transistor configurations. The expressions indicate methods of simplifying the design of transistor amplifiers, by reducing to within prescribed limits the effect of variations in the parameters. An extension of this method can be applied to two-stage amplifiers with single- or multiple-feedback loops.

621.382.333

3034 HEAT REMOVAL IN TRANSISTORS. W.Hilberg.

Telefunken Ztg, Vol. 32, 200-7 (Sept., 1959). In German.

Outlines the use of thermal equivalent circuits, gives expressions for the theoretical thermal transient-response for a number of one-dimensional situations with different boundary conditions, discusses methods of measuring junction temperature, and presents experimental observations of junction temperature-rise on a time-scale up to 90 sec., finally showing how these may be matched by particular equivalent circuits. F.F.Roberts

621.382.333.3

3035 THE NOISE FIGURE OF JUNCTION TRANSISTORS. J.J.Stewart.

Proc. Instn Elect. Engrs, Paper 2973 E, publ. May, 1959 [International Convention on Transistors and Associated Semiconductor Devices] Vol. 106B, Suppl. 17, 1056-66, 1072-4 (1959).

Republication, with discussion, of the paper abstracted in Abstr. 3669 (1959).

PHOTOELECTRIC DEVICES

621.383.2.032.35 : 518.5

3036 AN ELECTROLUMINESCENT DIGITAL INDICATOR WITH A SILICON CARBIDE CODING MATRIX. D.H.Mash.

J. sci. Instrum., Vol. 37, No. 2, 47-50 (Feb., 1960).

A digital indicator is described using an electroluminescent panel having its back electrode shaped as an array of lines, from combinations of which the digits are formed. Also described is a coding matrix which greatly simplifies the electrical switching needed for the indicator. The coding matrix utilizes the non-linear electrical properties of silicon carbide powder to discriminate between the voltage, applied to wanted elements and unwanted elements, and allows a single-pole ten-ways switch to be used for selecting the required digit.

621.383.27

3037 PHOTOMULTIPLIERS FOR RADIATION DETECTION. G.Pietri.

Onde elect., Vol. 38, 606-16 (Aug.-Sept., 1958). In French.

A review of photomultiplier operation in the scintillation detection of nuclear particles is given, followed by an illustrated description of manufacturing methods.

621.383.27

3038 A VERY SHORT LIGHT PULSE GENERATOR USED FOR TESTING PHOTOMULTIPLIERS. P.Cachon and A.Sarazin.

Onde elect., Vol. 38, 617-21 (Aug.-Sept., 1958). In French.

A very short light-pulse generator, obtained by electronic excitation of the screen of cathode ray tube, is used for testing photomultipliers. The shape and positional stability of these pulses permit accurate measurement of the transit time and fluctuations. Results of measurements are given.

621.383.27 : 537.533

3039 RESISTANCE STRIP MAGNETIC PHOTOMULTIPLIER FOR THE EXTREME ULTRAVIOLET. L.Heroux and H.E.Hinteregger.

Rev. sci. Instrum., Vol. 31, No. 3, 280-6 (March, 1960).

The performance of a windowless resistance strip magnetic multiplier for detection of extreme ultraviolet is described. The detector is characterized by a high spectral sensitivity for wavelengths below 1400 A and a low sensitivity to longer wavelength radiation. It is reproducible in spectral response and gain after exposure to air or after cleaning. A current gain of 10^8 can be realized with the multiplier for an over-all voltage of approximately 2000 V. The photomultiplier can be operated as a photoelectron counter with a well-defined counting plateau for pressures below 10^{-6} mm Hg. The background counting rate of the detector, at room temperature and typical operation in the plateau region, is less than 0.1 count/sec.

621.383.4 : 621.376.222

TRANSISTOR PHOTOELECTRIC CHOPPER FOR D.C. OPERATIONAL AMPLIFIERS. See Abstr. 2994

621.383.42 : 537.7

3040 INTERNAL RESISTANCES AND CAPACITANCE OF A SELENIUM PHOTOCELL AT LOW TEMPERATURES. G.Blet.

J. Phys. Radium, Vol. 18, No. 10, 572-8 (Oct., 1957). In French.

The variations of capacitance of a photocell at low temperatures display phenomena similar to those observed for variations of resistance. Resensitization by means of near infrared also gives similar results. The two quantities, R and C, seem to be intimately associated and depend directly on the concentration of free electrons at a particular energy level, which has been evaluated.

ELECTRON TUBES

621.385.032.213.13 : 537.533

3041 THE OXIDE CATHODE OF A SANDWICH STRUCTURE. S.Nakamura and E.Sugata.

Technol. Rep. Osaka Univ., Vol. 8, 261-71 (Oct., 1958).

Oxide cathodes with a sandwich structure, from which a stable emission current of large density in d.c. operation can be drawn, are described. The ordinary oxide-coated cathode is covered with a metal cap containing a hole or slit, and the gap between the base metal and its cap is filled up with the oxide materials, like a sandwich. Experimental results are presented. The operating mechanism is similar to that of "hollow cathodes". The beam drawn from the cathode slit (or hole) kept its sharp strip (or hollow) form in various operating conditions. Even if the activated cathode is exposed to the atmosphere at room temperature, the emission current recovers its initial value.

621.385.3.029.64

3042 A METAL–CERAMIC DISC-SEAL TRIODE FOR FREQUENCIES UP TO 6000 Mc/s. E.Mentzel and H.Stietzel.

Philips tech. Rev., Vol. 21, No. 3, 104-8 (1959-60).

Description of an experimental disc-seal triode provisionally designated as type OZ 92. Its electrode system is the same as in the EC 59, but its wall is of ceramic (Al_2O_3) and metal (an Fe–Ni–Co alloy). The advantages of ceramic over glass are: (1) higher thermal loading permissible owing to better heat conduction, and no electrolysis, even at high temperatures; (2) lower dielectric losses; (3) greater resistance to deformation at high temperatures. This valve is of very simple design, capable of delivering more than 10 W at 5000 Mc/s. The anode dissipation is 125 W, for which either water or air cooling is adequate. Anode voltage 500 V. The maximum permissible temperature of the metal–ceramic seals is 250°C.

621.385.5

3043 SOME PARTICULAR PHENOMENA OBSERVED IN THERMIONIC TUBES IN WHICH THE SCREEN IS NOT DECOUPLED. I. SLOPE AND NEGATIVE-RESISTANCE EFFECTS IN THERMIONIC TUBES WITH SCREEN NOT DECOUPLED. M.Cehan-Racovită.

Stud. Cercetari Energetica, Vol. 7, No. 4, 759-76 (1957). In Roumanian.

The phenomena considered appeared in pentodes, hexodes and heptodes. The occurrence of negative slope characteristics is demonstrated for the following: anode current — voltage on grid 1 and cathode current — voltage on grid 1, when the impedance between screen and cathode is raised to a particular value. These effects may be used to obtain negative resistance of a reduced value.

621.385.6

3044 ON THE PERFORMANCE OF A CLASS OF HYBRID TUBES. S.V.Yadavalli.

Proc. Inst. Radio Engrs, Vol. 48, No. 2, 263 (Feb., 1960).

A tube in which the electron beam bunching section consists of a stagger-tuned multicavity klystron and the output section is a travelling-wave circuit having a pass-band greater than the operating frequency bandwidth of the bunching section is investigated. Calculations show that for a typical X-band tube a bandwidth of

170 Mc/s, a power output of 30 kW peak and an efficiency of 18% are possible. Experimental results confirm these figures.

R.C.Glass

621.385.632.1 : 621.317.34

MEASUREMENT OF INTERNAL REFLECTIONS IN TRAVELLING-WAVE TUBES USING A MILLIMICROSECOND PULSE RADAR. See Abstr. 2809

621.385.623.5 : 621.316.726

FREQUENCY STABILIZATION OF A REFLEX KLYSTRON OSCILLATOR. See Abstr. 2760

621.385.633.12

3045 THE MINIMUM NOISE FIGURE OF THE BACKWARD WAVE AMPLIFIER. A.J.Fox.

J. Electronics and Control, Vol. 7, No. 3, 270-1 (Sept., 1959).

In helix circuit b.w.a's the fields have a phase varation with angle of azimuth. However, the noise waves at the cathode are ideally zero-order modes with no azimuthal phase. Thus, the theoretical minimum noise figure is zero because the noise waves cannot couple to the circuit. A.H.W.Beck

621.385.64

3046 A RANGE OF PULSED MAGNETRONS FOR CENTIMETRE AND MILLIMETRE WAVES. J.Verweel and G.H.Plantinga.

Philips tech. Rev., Vol. 21, No. 1, 1-9 (1959-60).

A description is given of a range of experimental magnetrons for wavelengths of 32, 12, 8 and 4 mm and delivering peak outputs of 1100, 70, 80 and 40 kW respectively. The range has been designed around one basic construction and the influence of scaling factors on the design is considered. All the tubes use a hobbed rising-sun anode and an axially mounted L-type cathode. The cathode of the 32 mm valve, which is designed for a high mean power, has a heat dissipation of 120 W. The small dimensions of the 4 mm tube necessitate a special cathode assembly method. Some preliminary life-test figures are given. B.Dunford

621.385.832 : 621.374.32

3047 AN EXPERIMENTAL FLYING-SPOT STORE FOR ELECTRONIC SWITCHING. C.W.Hoover, Jr.

Bell Lab. Record, Vol. 37, No. 10, 367-72 (Oct., 1959).

An image of the c.r.t. spot is focused by condensing lenses on to each of a number of film storage plates. The plates store binary-coded information in the form of transparent or opaque areas. Photomultiplier tubes are used as detectors. Very accurate positioning of the spot is necessary, and this is ensured by two independent X and Y beam sensing systems with feedback to the deflector plates. Sensing is effected by cylindrical lenses which project a line image of the spot on to an encoder plate, giving a digital output for comparison with digital positioning instructions. Sufficient channels can be used to read out all the bits of a word simultaneously. W.G.Stripp

621.385.832

3048 TRANSIENT STORAGE OSCILLOSCOPE. A.E.Cawkell and R.Reeves.

Electronic Technol., Vol. 37, No. 2, 50-9 (Feb., 1960).

A brief history is given, the "Remscope" being commenced in 1958. Two commercial tubes compared are the Hughes "Memotron" and the R.C.A. 6866/English Electric E 702 A, the latter being preferred. The tube has a double gun, one of which is the normal X and Y and the other the viewing or "flood" gun. Close to the back of the screen is a storage-mesh backing-electrode, forming a multitude of storage capacitors. Other control grids are present and the complete action is described. The tube may be used in four modes: (a) store; (b) read; (c) automatic; and (d) normal oscilloscope. Other than for the power-supply unit, printed circuits are used. Applications are to once-recurring transients, both slow and fast, and some examples of microswitch and relay contact operation are given. E.H.W.Banner

621.385.832.032.269.1

3049 CATHODE-RAY TUBE TRIODE GUN WITH BEAM FORMER ELECTRODE. W.F.Niklas.

Proc. Inst. Radio Engrs, Vol. 48, No. 1, 120-1 (Jan., 1960).

A triode gun, in which modulator and anode are surrounded by a cylindrical "beam former" electrode at an intermediate potential, was tested in a 5-in. c.r.t. flying-spot scanner. A substantial reduction in astigmatism should make it less sensitive to mounting tolerances than conventional designs. B.Meltzer

621.385.833 : 537.533

3050 SINGLE-VELOCITY EQUIVALENTS FOR MULTIVELOCITY ELECTRON STREAMS. G.A.Gray.

J. appl. Phys., Vol. 31, No. 2, 370-80 (Feb., 1960).

Several electron beam problems which involve a distribution in electron velocities are treated. In each case the actual multi-velocity stream is replaced by an equivalent single velocity stream. Such a procedure provides a common viewpoint for the examples which are considered. For a travelling-wave tube, it is found that a distribution of d.c. electron velocities has same effect as an increase in the space charge parameter Q.C. a result which is in agreement with the earlier findings of Watkins and Rynn. Agreement with earlier theories is also found in the cases of space charge wave propagation on a multi-velocity stream, and the doublestream amplifier. In the case of noise fluctations in high velocity beams, it is found that the time varying part of either the r.m.s. or the mean stream velocity may by used to specify the a.c. velocity modulation on the equivalent single-velocity beam. That is, either value should be equally valid in a first order treatment. Finally, a class of re-entrant beam devices is analysed, and experimental results are cited as an indication of the validity of the theory.

621.385.833 : 537.533

3051 ON THE CONCEPT OF FICTITIOUS SURFACE CHARGES OF AN ELECTRON BEAM. E.L.Chu.

J. appl. Phys., Vol. 31, No. 2, 381-7 (Feb., 1960).

The elctrodynamical phenomena in the boundary strip of a sharply focused electron beam are extremely complicated. This difficulty is usually resolved by postulating a layer of surface current on the boundary of the unperturbed beam while considering the troublesome boundary strip as nonexistent. A critical examination is made of this technique with the result that, if the calculated r.f. power is to be the same as in the actual beam, a layer of electric dipoles must also be postulated. The discussion begins with the Jacobian and Taylor's expansion, with particular emphasis on the applicability of the latter to the boundary strip, then proceeds to the formulation of a modified problem on an equal-power basis and the specification of the surface conditions which are to be satisfied. Second-order quantities are included in all equations, so that the small-signal beam kinetic quantities can be reliably calculated.

621.386.17

3052 AN APPARATUS FOR CINEFLUOROGRAPHY WITH AN 11-INCH X-RAY IMAGE INTENSIFIER. J.J.C.Hardenberg.

Philips tech. Rev., Vol. 20, No. 11, 331-45 (1958-59).

An image intensifier which has a screen of 11 in. diameter, a reduction factor of 4.5 and a luminance intensification of approx. 100×, which makes it possible to examine cinematographically such large organs as the heart and lungs. The construction and properties are discussed. A special cinefluorographic apparatus is also described comprising a 35 mm mirror cine-camera (effective aperture ratio 1 : 0.83), an optical viewing system allowing two observers to watch the image during cinefluorography, and a luminance meter to regulate the average photographic density of the film or, if required, automatically to keep it constant. The power supply for the X-ray tube contains a heat integrator, which safeguards the anode against overheating as a result of prolonged and severe loading. The cinefluorography apparatus, the X-ray tube and the examination table can be mounted on a "ring stand", which enables the patient to be tilted during the examination without shifting his position with respect to the X-ray beam. The application of the apparatus to angiocardiography is also discussed.

621.386.8 : 621.389

3053 MEDICAL APPLICATIONS OF FLUOROSCOPIC IMAGE INTENSIFICATION. I. G.Henny.

I.R.E.Trans Med. Electronics, Vol. ME-6, No. 2, 75-8 (June, 1959).

A review is given of the general problem of image intensification and the limitations imposed by sensitivity of the eye to contrast at low levels of illumination. F.T.Farmer

621.386.8 : 621.389

3054 MEDICAL APPLICATIONS OF FLUOROSCOPIC IMAGE INTENSIFICATION. II. H.M.Stauffer.

I.R.E. Trans Med. Electronics, Vol. ME-6, No. 2, 78-81 (June, 1959).

Experience with both the Philips and Westinghouse instruments is described, including the use of spot films taken with a Polaroid-Land camera as alternative to direct radiographs, and cine radiography with simultaneous recording of speech and sound. A cine

camera recording a c.r.t. trace (of blood pressure, e.c.g. pattern etc.) as well as the radiographic image is also described. This has been used for the study of movement of contrast media in a dog's heart. F.T.Farmer

621.389 : 621.386.8

3055 MEDICAL APPLICATIONS OF FLUOROSCOPIC IMAGE INTENSIFICATION. III. J.Kirkpatrick.

I.R.E.Trans Med. Electronics, Vo. ME-6, No. 2, 62-3 (June, 1959).

The value of image intensification lies in: (1) routine radiology, particularly on children; (2) teaching, allowing several persons to observe the screen with equal facility; and (3) research, principally by cine radiography. In this latter category a number of instances are detailed where the information gained has been greatly increased as compared with ordinary radiographic methods. F.T.Farmer

621.386.8

3056 STANDARDS FOR MEASUREMENT OF BRIGHTNESS INTENSIFICATION IN FLUOROSCOPIC IMAGE INTENSIFIERS. W.S.Lusby.

Trans Amer. Inst. Elect. Engrs I, Vol. 78, 504-6 (1959) = Commun. and Electronics, No. 45 (Nov., 1959).

The normal ratios of brightness are meaningless, due to unspecified variables. It is suggested that a standard ratio be defined under the following operating conditions: 80 kVp, 2 cm Al filter (H.V.L. 6.5 mm Al), Prestwood phantom with Al absorber to simulate patient, target-screen dist. 66 cms, temperature 20°C. The measuring instrument must have a response parallel to that of the photopic eye. F.T.Farmer

GAS DISCHARGES
GAS-DISCHARGE TUBES

621.387.424 : 537.533 : 539.1.07

3057 THE WORK FUNCTION OF CATHODES FOR ELECTRONS AND THE PERFORMANCE CHARACTERISTICS OF GEIGER-MÜLLER COUNTING TUBES. O.Orient.

Acta phys. Hungar., Vol. 7, No. 2, 199-206 (1957).

The relation is investigated between the work function of counting-tube cathodes and the performance characteristics of the tubes. The cathode materials are Zn, Cd, Cu, and Ni. The results show that for counting tubes of identical geometry and filled to the same pressure, the plateau is longer and its slope lower for tubes with cathodes characterized by larger work functions. For identical overvoltages, the electric charge liberated per count is proved to be the same in counting tubes with different cathodes. It follows that, other conditions being equal, the number of ions per discharge is independent of the material of the cathode.

621.387 : 537.56

3058 ION ENERGIES IN A COLD CATHODE DISCHARGE IN A MAGNETIC FIELD. J.Backus and N.E.Huston.

J. appl. Phys., Vol. 31, No. 2, 400-3 (Feb., 1960).

A cold-cathode discharge in a strong magnetic field was studied by means of a pulsing technique. The discharge was run at pressures of a few microns with magnetic field of 2.4 kG and currents ~0.5 A. By means of multivibrator and amplifier the discharge was pulsed off for 300 μsec at 1000 μsec intervals. During the off-period the current flow to the cathodes was observed. Analysis of the current flow shows an approximately Maxwellian distribution of velocities at the cathodes with a temperature of about 0.5 eV. This gives an ion density in the discharge of approximately 20%.

ELECTRONIC EQUIPMENT

621.389

3059 RADIATION-TOLERANT ELECTRONIC EQUIPMENT. J.R.Burnett.

I.R.E. Trans Nuclear Sci, Vol. NS-6, No. 4, 12-15 (Dec., 1959).

A comprehensive filing system of radiation-effects data has been compiled and forms the basis of a development programme: this filing system is described in detail. The present effort is based on modification of operational military equipment by selective replacement of radiation sensitive parts with parts having a higher radiation tolerance. An unmodified ARN-32 beacon receiver has a predicted 5% threshold failure when exposed to 2×10^{18} nvt. The 5% threshold failure of the modified version was predicted at 4×10^{18} nvt. The beacon receiver was irradiated for more than 370 hr over a period of 55 days and was still serviceable after being exposed to an epicadmium neutron flux of 3×10^{17} nvt. J.MacCormack

621.389

3060 SOME EFFECTS OF HYPERSONIC IONIZATION ON THE DESIGN OF ELECTRICAL AND ELECTRONIC COMPONENTS. W.B.Sisco and J.M.Fiskin.

Trans Amer. Inst. Elect. Engrs II, Vol. 78, 352-6 (1959) = Applic. and Industr., No. 45 (Nov., 1959).

During hypersonic flight aircraft components may be affected either by high temperature or by shock-wave ionization. External temperatures of the order of 1000° K necessitate some form of cooling and heat insulation. The effects of ionization are to alter the radiation impedance of the aerials and reduce their breakdown voltage and to increase both receiver noise input and radar cross-section. An outline is given of the methods of calculating the distribution of temperature and ionization in the shock wave. W.T.Blackband

621.389

3061 PERCOS — PERFORMANCE CODING SYSTEM OF METHODS AND DEVICES USED FOR MEASUREMENT AND CONTROL. E.A.Keller.

Proc. Inst Radio Engrs, Vol. 48, No. 2, 148-55 (Feb., 1960).

Describes a classifying and coding system of functions and performance characteristics of devices in a way that is useful to the systems designer, who must select a chain of compatible instruments to achieve a measurement or control system of prescribed accuracy and reliability. The performance coding system consists of numeric codes for rating a device in terms of twelve parameters of importance to the overall performance of the system, such as precision, stability of calibration, rate of performance, useful shelf life, mean operating time to failure, average repair time, cost availability and physical volume. The numeric codes provide a quantitative description of the performance data to the nearest order of magnitude only. However, this broad classification is consistent with the magnitude of the expected span of performance data of all the devices in a compled system. An edge-coded card system is described for the selection of devices or methods complying with the performance parameters. The individual card specifies the exact technical data of the device, the input and output requirements, and especially the environmental conditions under which the performance parameters are given. This classification is established for and with the cooperation of I.R.E. Subcommittee 10.3 of the Industrial Electronics Committee.

621.389

3062 RELIABILITY ANALYSIS TECHNIQUES. C.A.Krohn.

Proc. Inst. Radio Engrs, Vol. 48, No. 2, 179-92 (Feb., 1960).

Reliability analysis has progressed to the point where a quantification of reliability is possible. Reliability models for electronic equipment and techniques for interpretation of field and laboratory data have been developed. Of more significance, analytical methods leading to higher reliability are available. Reliability estimates enable early pinpointing of low reliability. Catastrophic failures can be controlled and performance change failures reduced through analytical techniques. Redundant techniques allow further reliability improvement even though failures occur. Analytical techniques are a useful aspect of reliability improvement, but they comprise only a part of reliability improvement methods.

621.389 : 535.33

3063 HIGH SPEED SPECTROGRAPH SHUTTER. J.C.Camm.

Rev. sci. Instrum., Vol. 31, No. 3, 278-9 (March, 1960).

An electromechanical shutter is described which will open and close a 20 μ spectrograph slit in 5 μsec after a delay of 20 μsec. The shutter incorporates a movable slit which is propelled across the stationary spectrograph slit by the thermal expansion of a Joule-heated hairpin-shaped Nichrome wire.

621.389

3064 DIRECTIONAL FISH COUNTER FOR FIELD USE. R.H.vanHaagen and J.Rockwell, Jr.
Rev. sci. Instrum., Vol. 31, No. 3, 342-3 (March, 1960).

621.389 : 621.317.39

3065 ELECTRONIC SECTOR-SCANNING ASDIC: AN IMPROVED FISH-LOCATOR AND NAVIGATIONAL INSTRUMENT. D.G.Tucker and V.G.Welsby.
Nature (London), Vol. 185, 277-9 (Jan. 30, 1960).

Results are given of successful sea-trials made with an experimental model of a new electronically scanned underwater echo-location system. This greatly increases the rate at which such an echo-location system can pick up information. A further system giving even higher resolution is being developed. V.G.Welsby

621.389

3066 TRANSISTORIZED AUDIOMETER. H.J.F.Crabbe and P.Denes.
Wireless Wld, Vol. 65, No. 11, 563-5 (Dec., 1959).

A compact instrument for children giving four spot frequencies (0.5, 1, 2 and 4 kc/s) and five intensities (0, 20, 40, 60, 80 dB above threshold) is described. It is simple to operate and less obtrusive than the larger types of instrument. F.T.Farmer

621.389 : 621.372.4

3067 SOME FUNCTIONS OF NERVE CELLS IN TERMS OF AN EQUIVALENT NETWORK. W.H.Freygang, Jr.
Proc. Inst. Radio Engrs, Vol. 47, No. 11, 1862-9 (Nov., 1959).

A distributed parameter equivalent network of a nerve cell is developed. The network is based upon the electrical constants of nervous tissue. Inserted in the network are electrically and chemically activated generators. Some experimental evidence is given for the properties of the network and the generators, as well as for the location of the generators in the network. The function of the neurons in the nervous system is discussed in terms of this network.

621.389 : 621.372.6

3068 MULTIPOLE REPRESENTATION FOR AN EQUIVALENT CARDIAC GENERATOR. D.B.Geselowitz.
Proc. Inst. Radio Engrs, Vol. 48, No. 1, 75-9 (Jan., 1960).

One facet of electrocardiography has traditionally dealt with the relationship between body surface potentials and an equivalent generator that could have produced them. A key problem facing investigators today is whether a single fixed-location dipole is a suitable equivalent generator. The equivalent cardiac generator developed here provides a means for resolving this question. It consists of a collection of multipoles which, if placed at a point in a homogeneous isotropic conductor shaped like the human body, will give rise to the same potential distribution on the surface as that observed on the body itself. The multipole components can be evaluated by performing appropriate integrations of the potential over the body surface.

621.389 : 621.317.39

INSTRUMENTATION FOR AUTOMATICALLY PRE-SCREENING CYTOLOGICAL SMEARS. See Abstr. 2830

621.389 : 621.386.8

MEDICAL APPLICATIONS OF FLUOROSCOPIC IMAGE INTENSIFICATION. See Abstr. 3053-5

621.389 : 621-526

MEASUREMENT OF MECHANICAL PROPERTIES OF MUSCLE UNDER SERVO CONTROL. See Abstr. 3193

TELECOMMUNICATION

621.391

3069 ORTHOGONAL CODES. H.F.Harmuth.
Proc. Instn Elect. Engrs, Monogr. 369E, publ. March, 1960, 7 pp.
To be republished in Part C.

Code alphabets whose characters can be represented by a finite sequence of digits of value +1 or −1 have been extensively investigated. The characters of these binary codes may be considered to be superpositions of orthogonal functions, one for each digit, which are multiplied by +1 or −1. A character of an orthogonal code consists of one function of a set of orthogonal functions multiplied by +1 or −1.

621.391

3070 ORTHOGONAL MATRICES, ERROR-CORRECTING CODES AND LOAD-SHARING MATRIX SWITCHES. R.T.Chien.
I.R.E. Trans Electronic Comput., Vol. EC-8, No. 3, 400 (Sept., 1959).

An orthogonal matrix of order n by n gives an error-correcting code of size n with distance n/2 and if it is combined with its complement it gives an error-correcting code of 2n sequences with minimum distance n/2. A pseudo-orthogonal matrix is used to construct an error-correcting code of size 2n with distance:

$$\frac{n}{2} - 1 \leq d \leq \frac{n}{2} + 1$$

The construction is possible for any $n = 2 \pmod 4$, if $n - 1$ is a prime, and a design of a load-sharing matrix switch can also be derived from it, giving a very much lower number of inputs than required by the methods of Constantine and Marcus, e.g. for 72 outputs Constantine requires 256 inputs, Marcus 128, and Chien 76 or 74. G.A.Montgomerie

621.391

3071 AN ESTIMATE OF THE CHANNEL CAPACITY OF CERTAIN COMMUNICATION LINKS WITH RANDOMLY VARYING PARAMETERS. Ya.I.Khurgin.
Radiotekhnika, Vol. 14, No. 12, 19-27 (Dec., 1959). In Russian.

The calculations are made for single and multiple circuits on the assumption that the transmitted signal, the transmission coefficient of the medium, the propagation time and the additive noise are all mutually independent stationary random processes. In particular an example is given of a single beam communication link where the effects of fluctuation in transmission and additive noise are taken into account. S.C.Dunn

621.391

3072 THE APPLICATION OF THE METHOD OF SEQUENTIAL ANALYSIS TO BINARY COMMUNICATION SYSTEMS WITH A RAYLEIGH DISTRIBUTION OF SIGNAL INTENSITY FLUCTUATION A.E.Basharinov and B.S.Fleishman.
Radiotekhnika i Elektronika, Vol. 4, No. 2, 155-60 (Feb., 1959). In Russian.

Systems for processing fluctuating signals using sequential analysis are considered. The average time characteristic and the probability of correct signal detection are calculated for the case of transmission with passive spaces, when the probability of false response is small in comparison with the permissible probability of missing the signal. The results show that the method of sequential analysis may be used for increasing the efficiency of a binary signal transmission system when the elementary signal is transmitted by a sequence of identical pulses. (English summary PB 141106T-13, obtainable from Office of Technical Services, U.S Dept. of Commerce, Washington D.C., U.S.A.). R.C.Glass

TELEGRAPH AND TELEPHONE SYSTEMS

621.395.31

3073 OPTIMUM SIZE OF OVERFLOW TRAFFIC GROUPS. M.M.Jung.
Philips Telecomm. Rev., Vol. 21, No. 1, 32-42 (Aug., 1959).

Instead of routing all traffic between two centres via a group of direct trunks, it is often economical to route part of it as overflow traffic via an intermediate transit centre. Elaborating a method given by Wilkinson (see Abstr. 3589 of 1956) a set of practical curves was constructed with which it is possible to determine the most economical number of trunks for the direct and overflow routes

when the relative cost for a traffic channel on each of the routes concerned, and the traffic figures are known. These curves hold good for intensities of up to 15 erlangs for the traffic offered to the direct route. The use of these curves is illustrated by a few examples.

621.395.31

3074 INTERURBAN TELEPHONE TRAFFIC WITH AUTOMATIC EQUIPMENT. I.Constantinescu.
Telecommunatii, Vol. 3, No. 3, 103-10 (May-June, 1959). In Roumanian.

A review of probability calculus as applied to telephony is presented, followed by a discussion of two methods which can be used in calculating the optimal number of circuits and equipments. Examples are provided.

621.395.44

3075 CARRIER TELEPHONE SYSTEMS INCORPORATING BASIC TYPE STR 109 EQUIPMENT. J.H.van Gelderen.
Philips telecomm. Rev., Vol. 21, No. 1, 13-31 (Aug., 1959).

A detailed description is given of a 60-channel system for balanced carrier cables, of 24-, 60- and 120-channel systems for radio links, of 12- and 120-channel systems for de-loaded v.f. cables, and of a 12-channel system for open-wire lines.

TELEPHONE EQUIPMENT COMMUNICATION NETWORKS AND CABLES

621.395.722

3076 SION TANDEM EXCHANGE. M.Morand and H.Hauser.
Tech. Mitt. P.T.T., Vol. 38, No. 2, 51-61 (1960). In French.

The new Sion automatic exchange is described which plays a major part in the flow of telephone traffic in Western Switzerland. Only four-wire circuits are used within the exchange, all two-wire circuits being converted to four-wire operation by end repeaters; all circuits are brought to the same transmission level of −0.4 neper, thus avoiding the necessity of gain adjustments when transit connections are established. The number of relay and selector contacts in the speech path is very much reduced, and the remaining contacts occur at points of higher level. The reconstruction of the network served by the new exchange is described. A general description of the exchange equipment is given, including traffic-flow diagrams.
J.M.Silberstein

621.395.724

3077 AMPLIFICATION BY MEANS OF 2-POLE NEGATIVE IMPEDANCES ON NON-LOADED CABLES. G.Tamburelli.
Alta Frequenza, Vol. 28, No. 5-6, 579-608 (Oct. - Dec., 1959). In Italian.

The application of amplifiers of this type is limited by the question of stability. Theoretical and experimental results are given showing the maximum gain obtained, with particular cables, in the audio frequency range. V.G.Welsby

ELECTROACOUSTIC APPARATUS

621.395.61

3078 MODERN ACOUSTICAL ENGINEERING. I. GENERAL PRINCIPLES. II. ELECTROACOUSTICAL INSTALLATIONS IN LARGE THEATRES. D.Kleis.
Philips tech. Rev., Vol. 20, No. 11, 309-26 (1958-59); Vol. 21, No. 2, 52-72 (1959-60).

A survey of the art of sound reinforcement and distribution, both in buildings and outdoors. A brief review of hearing characteristics and auditorium acoustics is followed by a description of the equipment available. Modern systems can be applied to give results which are so natural as to be acceptable as aids to important musical and dramatic performances, e.g. opera. Intelligibility and naturalness are preserved by the use of directional loudspeakers in monophonic or stereophonic arrays, due attention being paid to wavefront arrival times. The acoustic atmosphere and the reverberant impression can often be improved by introducing some suitable diffuse indirect sound from loudspeakers distributed in the auditorium (ambiophony). The effects of wind and temperature gradient on outdoor sound propagation are touched on. Descriptions are given of some large musical and industrial indoor installations and of some large outdoor systems. M.L.Gayford

621.395.62

3079 POSSIBILITIES OF THE SIMULATION OF THE ACOUSTIC IMPEDANCE OF THE HUMAN EAR BY AN EQUIVALENT CIRCUIT. J.Kacprowski.
Acta tech. Hungar., Vol. 22, No. 3-4, 255-63 (1958). In German.

621.395.62

3080 MAGNETIC DUAL-DUBBING REPRODUCER. C.E.Hittle.
J. Soc. Motion Picture Televis. Engrs, Vol. 68, No. 9, 594-5 (Sept., 1959).

The two reproducing units, which are intended for use with 35, 16 and 17.5 mm film, are accommodated on one standard 19 in rack. This is effected by arranging the take-up spool of each vertically below its associated wind-off spool and by spacing the two spools of one unit both vertically and horizontally with respect to those of the other unit. Improved drive is achieved by mounting two heavy spaced plates one behind the other at the back of the front panel so providing two bearings for all motors, sprocket shafts, etc. A belt drive with 3 : 1 speed reduction permits the use of smaller torque motors. These motors cannot be switched on without the film being threaded up. H.G.M.Spratt

621.395.623.7 : 534.6

3081 AUTOMATIC RECORDING OF CURVES OF EQUAL PHASE SHIFT. V.Gavreau and A.Calaora.
Acustica, Vol. 6, No. 6, 539-42 (1956). In French.

An automatic apparatus for tracing these curves in a plane section of a three-dimensional sound field is described. This is applied to the sound field of a loud-speaker and to the effects of interposed obstacles. The sound waves so observed have peculiar shapes; they appear as lenticular chaplets, rather like those obtained in photo-elastic studies.

621.395.623.7 : 534.6

3082 MEASUREMENT OF AMPLITUDE AND PHASE DISTRIBUTION ON CONICAL LOUDSPEAKER DIAPHRAGMS. F.Eggers.
Acustica, Vol. 7, No. 1, 21-8 (1957). In German.

A continuous record of amplitude and phase over the whole conical diaphragm of a loudspeaker was made. Whereas the motion at low frequencies is of the piston type, at moderate frequencies azimuthal variations, and at higher frequencies radial variations, become apparent. With warble tones or noise bands, a ring zone of maximum amplitude appears on the membrane, which moves towards the centre as the frequency goes up. The piston type vibration is more important for radiation at low and middle frequencies, the azimuthal flexural waves superposed thereon having little effect.

621.395.623.7

3083 INTERMODULATION DISTORTION IN LOUDSPEAKERS. J.Merhaut.
Slaboproudy Obzor, Vol. 21, No. 1, 3-10 (1960). In Czech.

It is assumed that two sinusoidal signals of frequencies f_1 and f_2, such that $f_1 \ll f_2$, are applied to the driver of a loudspeaker. If the amplitude response of the loudspeaker is nonlinear, its output signal contains a number of intermodulation components ($f_2 - f_1$, $f_2 + f_1$, $f_2 - 2f_1$, etc.). An expression for determining the magnitude of this intermodulation distortion is derived. The loudspeaker is also subject to the frequency distortion which is caused by the Doppler effect. The output signal is frequency-modulated by f_1. A formula for evaluating the magnitude of this distortion is derived. The formula was used to construct a diagram showing the Doppler-type distortion as a function of the loudspeaker deflection at the frequency f_1. The intermodulation was also investigated experimentally and the results are shown in two tables and two graphs. The agreement between the theory and the experiment is satisfactory. R.S.Sidorowicz

621.395.625.3 : 681.142

3084 ON THE OPTIMUM DESIGN OF MAGNETIC DRUM STORE. D.D.Majumdar.

J. Instn Telecomm. Engrs (New Delhi), Vol. 5, No. 4, 211-22 (Sept., 1959).

A survey of the various factors influencing design, including choice of scanning rate, drum size, information packing density and type of coating. Several types of read–record head are discussed, as are aerodynamic effects and the problem of track-switching. Parameters are suggested for an optimum design of drum although it is pointed out that this depends to some extent upon the particular computer application it is intended for. G.H Stearman

621.395.625.3 : 621.316.718.5

3085 SPEED CONTROL OF A SYNCHRONOUS INDUCTION MOTOR IN PRECISION MAGNETIC RECORDING SYSTEMS. L.A.Pusset.

Avtomat. i Telemekh., Vol. 19, No. 6, 574-81 (1958). In Russian. English summary: PB 141096T-5, obtainable from Office of Technical Services, U.S. Dept.of Commerce, Washington, D.C., U.S.A.

The stability of the speed-control system is analysed for a case when a phase discriminator of the electronic or electromechanical type is used as a sensitive element.

621.395.625.3

3086 CHOICE OF THE OPERATING POINT IN MAGNETIC RECORDING. K.Dušek.

Slaboproudy Obzor, Vol. 21, No. 1, 34-5 (1960). In Czech.

By considering dynamic characteristics (remanence plotted againts l.f. current) of a magnetic recording tape, it is concluded that the optimum operating point should correspond to the point of inflection on the characteristics. The magnitude of the magnetic bias at this point can be determined by applying a very small constant signal and plotting the response of the recorder while varying the bias. The point of maximum response is the optimum operating point. The choice of this point results not only in maximum output signal, but also in minimum nonlinear distortion. R.S.Sidorowicz

RADIOCOMMUNICATION

621.396.2 : 621.396.65

3087 DEVELOPMENT OF WIDE-BAND RADIO LINKS FOR TELEPHONY CHANNELS, TELEVISION AND SOUND PROGRAMME CHANNELS. T.Forberg.

Elektrotek. T., Vol. 73, No. 4, 49-54 (Feb. 5, 1960). In Norwegian.

A wide band radio link system over 4000 km long will transmit radio and television programmes to more than 50 broadcasting and television stations which are either already in operation or will be built as part of a 6-yr plan. The system will comprise a 2-way wide-band radio link for up to 960 telephone channels, a one-way television line, a 2-way standby link for up to 960 telephone channels which can alternatively transmit television (the standby link is coupled in automatically when either television or telephone lines break down), and a two-way auxiliary line to carry monitoring, service, conference or sound channels. The layout of the terminal and relay stations and the input to the Tryvass radio tower in Oslo is explained. G.N.J.Beck

621.396.2 : 621.397.2

EXPERIENCE WITH LONG-DISTANCE TELEVISION FIELDS USED FOR RETRANSMISSION. See Abstr. 2543

621.396.41

3088 COMPANDOR LOADING AND NOISE IMPROVEMENT IN FREQUENCY DIVISION MULTIPLEX RADIO-RELAY SYSTEMS. E.M.Rizzoni.

Proc. Inst. Radio Engrs, Vol. 48, No. 2, 208-20 (Feb., 1960).

Graphical and numerical means are developed to compute the additional effective loading caused by the use of syllabic compandors on the input of a multichannel radio-relay system, and to evaluate the noise improvement yielded by the compandor in a telephone channel.

TRANSMITTERS . RECEIVERS

621.396.621.54

3089 SELF-OSCILLATING FREQUENCY CHANGERS EQUIPPED WITH AN OC 170 R.F. TRANSISTOR.

Electronic Applic., Vol. 19, No. 4, 129-38 (1958-59).

A frequency-changer, primarily intended for operation in the range from 6 to 26 Mc/s but which can also be used in the medium-wave range, is described. The i.f. is produced by mixing the second harmonic of the local oscillation with the incoming r.f. signal. This method has special advantages with respect to conversion gain, the number of contacts necessary on the wave range switch and, finally, with respect to the general circuit lay-out. Generally, in self-oscillating transistor frequency-changers, such difficulties as phase shift of slope, frequency drift and pulling, increase rapidly with frequency, especially exceeding about 12 Mc/s. It is shown that second harmonic mixing is of particular advantage above this frequency, although this type of mixing can also be applied in the lower frequency range. A number of points which are of importance for self-oscillating frequency-changers in general are first discussed, and a comparison is drawn between the second-harmonic frequency-changer and two conventional circuits. Subsequently a practical second-harmonic frequency-changer is described. The oscillatory condition is derived and a method for the approximate calculation of the effective slope of the transistor is given.

RADIOFREQUENCY EQUIPMENT

621.396.662.4 : 621.372.413 : 538.56

3090 PLASTIC MICROWAVE CAVITIES FOR E.P.R. P.F.Chester, P.E.Wagner, J.G.Castle and G.Conn.

Rev. sci. Instrum., Vol. 30, No. 12, 1127-8 (Dec., 1959).

Describes an X-band, TE102 cavity made in epoxy resin (Hysol 6000 C-8). The material is strong, machines well and does not become brittle at liquid helium temperatures. A.H.W.Beck

AERIALS

621.396.67

3091 SUCCESSIVE VARIATIONAL APPROXIMATIONS OF IMPEDANCE PARAMETERS IN A COUPLED ANTENNA SYSTEM. M.K.Hu and Y.Y.Hu.

I.R.E. Trans Antennas and Propagation, Vol. AP-7, No. 4, 373-9 (Oct., 1959).

A new variational formulation for a single impedance parameter of an m-aerial system is presented. This formulation enables one to determine any self impedance Z_{ii}, one at a time, merely by exciting aerial i alone and leaving all the other aerials open circuited. For determining any mutual impedance Z_{ij}, only two independent excitations, one the same as that used for determining Z_{ii} and the other for determining Z_{jj}, are required. Thus, if all the $m(m + 1)/2$ impedances are required, only m independent excitation conditions are needed. In contrast to this, the formulation available in the literature is based on $m(m + 1)/2$ independent excitation conditions. Because of a reduced number of excitation conditions and the way they are assumed, the physical nature of the problem is made simpler and easier to comprehend. Such comprehension helps considerably in the choice of trial current distributions for a specific application. Two methods of evaluating the successive higher-order approximations are also given. One is based upon an orthogonalized process, and the other is based upon the successive inversion of matrices. In the evaluation of a certain order approximation, both methods have the advantage of utilizing all the work already done for the lower-order approximations; and at the same time, additional work required is considerably reduced. It is believed that the formulation, as well as the two methods of successive approximations, will also be useful in other problems.

621.396.67

3092 ANCHORAGE OF THE GUYS OF AN AERIAL MAST. F.Luera Puente.

Rev. Telecom., Vol. 14, 2-6 (Sept., 1959). In Spanish.

The conditions are investigated for the safe anchorage of the guys holding an aerial mast in its proper position. A detailed calculation is made for the dimensions of the anchorage block necessary for resisting the forces acting on the mast. A numerical example is given. R.Neumann

621.396.67

3093 DIRECTIONAL AND OMNIDIRECTIONAL ULTRA-SHORT WAVE AND TELEVISION AERIALS UTILIZING THE TUBULAR MAST AS REFLECTOR. R.Becker.
Telefunken Ztg, Vol. 32, 83-92 (July, 1959). In German.

Describes the performance and engineering problems associated with aerials for the 87-100 Mc/s band and television aerials for 47-68 Mc/s (Band I) and 174-223 Mc/s (Band III). For 87-100 Mc/s the aerials consist of an array of parallel-fed and suitably bent half-wave dipoles mounted on a tubular mast which acts as reflector for the dipoles. The resultant radiation pattern can be omnidirectional or largely directional, dependent upon the relative disposition of the aerial elements. Band III television aerials comprise an array of full-wave dipoles mounted similarly on a tubular mast. The amplitude and phase distribution of a single radiator varies and is dependent on the diameter of the mast. The resultant pattern can be calculated by vectorial addition of the patterns of the individual radiators. Band I television aerials comprise a turnstile arrangement of half- or full-wave dipoles. This aerial is usually mounted above the u.s.w. aerial on the same tubular mast, whose diameter is uniform throughout its length. Z.F.Voyner

621.396.674.3 : 538.56

3094 THE CONDUCTANCE OF DIPOLES OF ARBITRARY SIZE AND SHAPE. K.Fränz and P.A.Mann.
I.R.E. Trans Antennas and Propagation, Vol. AP-7, No. 4, 353-8 (Oct., 1959).

The real part of either the impedance of the admittance of dipoles of arbitrary size and shape can be computed rigorously without solving a boundary value problem of a partial differential equation. In analogy to a well-known method of potential theory, fields of standing waves can be generated by integrals over current filaments so that for a given frequency there exist dipole shaped surfaces normal to the electric field surrounded by distant surfaces of vanishing electric field strength. Boundaries of perfect conductors may be supposed to coincide with a dipole shaped surface and a distant closed surface. The transients of such fields of standing waves are intimately related to the steady state of the free radiating dipole, since, before the first waves reflected from the distant enclosure have come back, the dipole cannot know whether or not it is enclosed. Corresponding to the type of current filament, either the resistance, or the conductance, of the radiating dipole can be calculated by direct integrations, while the shape of the dipole is determined by an ordinary differential equation of first order. As an example, a family of dipoles that all have the same conductance $G = (254\ \Omega)^{-1}$ and a length 2h between limits $\lambda/2 \leq 2h \leq 1.36\ \lambda/2$ is calculated.

621.396.674.3

3095 A DIPOLE ANTENNA COUPLED ELECTROMAGNETICALLY TO A TWO-WIRE TRANSMISSION LINE. S.R.Seshadri and K.Iizuka.
I.R.E. Trans Antennas and Propagation, Vol. AP-7, No. 4, 386-92 (Oct., 1959).

The properties of a dipole coupled electromagnetically to a two-wire transmission line are studied experimentally. It is found that the coupling to the transmission line can be maximized by a proper choice of (1) angular position of the aerial with respect to the transmission line; (2) length of the aerial; and (3) separation of the aerial from the transmission line. The effect of spacing between the wires of the transmission line on optimum parameters is investigated. It is found that the optimum angular position of the aerial is not noticeably altered if, instead of a single aerial, an array of properly located aerials is used as the load. The advantage of an array built on this coupling principle is discussed.

621.396.677

3096 TRANSIENTS IN CYLINDRICAL ANTENNAE. H.J.Schmitt.
Proc. Instn Elect. Engrs, Monogr 377E, publ. April, 1960. 7 pp. To be republished in Part C.

The transient response of the radiation field of a driven cylindrical aerial is investigated for the particular case of a step-function excitation. The theoretical analysis makes use of Fourier's theorem to express the response as an integral over the response to all individual frequency components. The response as a function of time shows damped oscillations with a frequency determined by the first resonance frequency of the aerial. The response of the same aerial used as a receiver in a transient plane wave field is shown to be related to the radiation response by a simple integration process. By proper loading of the dipole, transient times of the order of the time needed for a wave to travel along the dipole axis can be obtained. An experimental investigation is described in which the reception of a transient field due to a shock-excited distant transmitter is observed.

621.396.677

3097 THE UNIDIRECTIONAL EQUIANGULAR SPIRAL ANTENNA. J.D.Dyson.
I.R.E. Trans Antennas and Propagation, Vol. AP-7, No. 4, 329-34 (Oct., 1959).

Circularly polarized unidirectional radiation, over a bandwidth which is at the discretion of the designer, is obtainable with a single aerial constructed by wrapping balanced equiangular spiral arms on a conical surface. The non-planar structure retains the frequency-independent qualities of the planar models, and, in addition, provides a single-lobe radiation pattern off the apex of the cone. Practical aerials have been constructed with radiation patterns and input impedance essentially constant over bandwidths greater than 12 to 1 and there is no reason to assume that these cannot be readily extended to more than 20 or 30 to 1.

621.396.677 : 621.396.969

3098 AERIAL INVESTIGATIONS USING NATURAL NOISE SOURCES. E.Eastwood.
Marconi Rev., Vol. 23, 2-20 (1st Qtr, 1960).

Describes experiments which utilize the quiet sun as a noise source at varying angles of elevation, in order to establish the radiation diagrams of the high performance radars required to provide the operational environment demanded by modern aircraft. The sun is a variable noise source and during its brief periods of enhancement spectacular radio and radar effects may sometimes result. A description is given of observations at 215 Mc/s made on the active sun of October 27th 1955 when evidence was obtained which suggests that a moon reflected signal was also obtained. Records are presented to illustrate the enhancement of the sun at sunrise on July 14th 1959. This event was followed by the reception of signals on July 15th 1959, which may be explained in terms of auroral activity consequent upon the arrival at the earth of charged particles emitted by the active sun.

621.396.677 : 621.396.969

3099 SOME MEASUREMENTS ON RADAR AERIALS, USING STELLAR NOISE. M.J.B.Scanlan.
Marconi Rev., Vol. 23, 21-32 (1st Qtr, 1960).

A short account of the sun as a noise source is given, together with a description of the experiments so far carried out, and an indication of how sensitivity can be improved, using radio astronomy techniques.

621.396.677 : 621.396.969

3100 AERIAL CALIBRATION BY SOLAR NOISE USING POLAR DISPLAY. M.H.Cufflin.
Marconi Rev., Vol. 23, 33-44 (1st Qtr, 1960).

During the summer of 1957, some experimental investigations were made at Bedell's End, near Chelmsford, with two objects in view. One was the possibility of using the radio noise of the sun as a suitably remote source for plotting the vertical polar diagram of an aerial. The other was an attempt to repeat an observation made by Eastwood in 1955 (see preceding abstract but one) of a suspected reflection from the moon during a very intense eruption of solar noise. The usefulness of the first aim was successfully demonstrated and has since been applied in research. The experimental equipment used is described and the reasons for particular circuit arrangements, with a description of some interesting records, are given. The second object of the work was not achieved. Normally, the level of the solar radiation was insufficient, but on the occasion when the sun was in an enhanced state of activity the moon was not in a position suitable for observation.

621.396.677

3101 CONSIDERATIONS AND ELECTRICAL MEASUREMENTS IN THE DESIGN OF THE AERIAL AT THE STOCKERT RADIO-OBSERVATORY. E.Schüttlöffel.

Telefunken Ztg, Vol. 32, 93-8 (July, 1959). In German.

Explains the reasons for the choice of the aerial and shows the design procedure and methods employed in its construction. The reflector is a paraboloid of revolution having a diameter of 25 m and being fed by a dipole at the focal distance of 7.45 m. Assuming 55% efficiency the calculated gain of the aerial at 21.1 cm is 48.8 dB. The characteristics of the aerial at 1420 Mc/s in the magnetic and electric planes respectively are: 3 dB beamwidth, 0.463° and 0.66°; 10 dB beamwidth, 0.74° and 1.16°; first side-lobe levels, 23.7 dB and 26.7 dB; the energy spill-over between 80° and 90° is 47.8 dB and 61.8 dB. The back lobe is 60 dB down on the main lobe. Good agreement is obtained between the calculated and measured results.

Z.F.Voyner

621.396.677

3102 MEASUREMENT ON LARGE PARABOLIC MIRRORS AT MICROWAVES WITH RADIO-ASTRONOMICAL AIDS. P.G.Mezger.

Telefunken Ztg, Vol. 32, 99-108 (July, 1959). In German.

Absolute calibration of the aerial of a radio-telescope or the determination of its gain is obtained using either of the two methods outlined: (a) calibrated noise receiver; (b) uncalibrated noise receiver. A distance point source is required in both cases. The methods were used for the calibration of the Stockert radio telescope (see preceding abstract) when it was possible to calculate exactly the shape of the main lobe, the squint of the main lobe and to evolve alignment procedure for the primary radiator in order to maximize the gain of the aerial.

Z.F.Voyner

621.396.677 : 538.56

3103 RANDOM ERRORS IN APERTURE DISTRIBUTIONS. R.H.T.Bates.

I.R.E. Trans Antennas and Propagation, Vol. AP-7, No. 4, 369-72 (Oct., 1959).

The effects of random manufacturing errors on polar diagrams of aerials are analysed in terms of the radius of correlation and mean square magnitude of the errors. The basis of the method is the Wiener–Khintchine theorem. Approximate general formulae are given for the reduction in gain and lowest probable side-lobe level. The implications of the theory are discussed.

621.396.677.3

3104 A NEW METHOD FOR OBTAINING MAXIMUM GAIN FROM YAGI ANTENNAS. H.W.Ehrenspeck and H.Poehler.

I.R.E. Trans Antennas and Propagation, Vol. AP-7, No. 4, 379-86 (Oct., 1959).

In conventional Yagi design, optimum performance requires separate adjustments in a number of parameters; array length and height, diameter, and spacing of directors and reflectors. By introducing the notion of a surface wave travelling along the array, it is possible to demonstrate experimentally the interrelationship between these parameters. Gain then depends only on the phase velocity of the surface wave (which is a function of height, diameter, and spacing of directors) and on the choice of reflector. Thus, maximum gain for a given array length, for any director spacing less than 0.5 λ, can be obtained by suitable variation of the parameters to yield the desired phase velocity. A design procedure that provides maximum gain for a given array length is presented.

621.396.677.3

3105 THE BACKFIRE ANTENNA, A NEW TYPE OF DIRECTIONAL LINE SOURCE. H.W.Ehrenspeck.

Proc. Inst. Radio Engrs, Vol. 48, No. 1, 109-10 (Jan., 1960).

This type of aerial consists of a slow-wave structure, such as a Yagi aerial, which is terminated in a conducting plane which reflects the travelling wave back to the feed point. The double traverse of the structure results in a radiation pattern equivalent to that of a structure of doubled length. Measured radiation patterns are plotted in order to show the effects of reflecting planes of various sizes.

W.T.Blackband

621.396.677.43

3106 STUDIES ON A RHOMBIC ANTENNA WITH CYLINDRICAL HELICES AS THE ARMS. A.K.Sen.

Indian J. Phys., Vol. 32, No. 7, 303-16 (July, 1958).

The input impedance and directivity of a rhombic aerial with arms in the form of cylindrical helices of constant pitch angle were studied. On the basis of certain plausible assumptions, theoretical expressions are derived to obtain impedance and directivity. Results are compared with experimentally observed values.

621.396.677.5 : 538.56

3107 RADIATION PROPERTIES OF A THIN WIRE LOOP ANTENNA EMBEDDED IN A SPHERICAL MEDIUM. O.R.Cruzan.

I.R.E. Trans Antennas and Propagation, Vol. AP-7, No. 4, 345-52 (Oct., 1959).

Formulae for certain radiation properties of a spherical aerial are derived theoretically. The aerial which consists of a spherical medium, such as ferrite, with a thin wire loop embedded just below the surface in an equatorial plane, is driven by a slice generator. For the spherical medium, the permeability K_μ and the dielectric constant K_ϵ are assumed to be scalars and, in general, complex. The solutions are facilitated through the expansion of the fields in terms of characteristic orthogonal spherical-vector wave-functions. The properties for which formulae are derived are current distribution, input impedance, input power, radiated power, power loss in the spherical medium, and the efficiency of the aerial. For radiation resistance, not only the general case formula but also the formula for electrically small aerials is given, and the difference between these formulae, for media assumed lossless, is shown graphically.

621.396.677.71

3108 AN EXPERIMENTAL STUDY OF THE SLOT AERIAL AND THE THREE-ELEMENT COLLINEAR ARRAY OF SLOT AERIALS. R.King and H.Owyang.

Proc. Instn Elect. Engrs, Monogr 365 E, publ. March, 1960, 12 pp. To be republished in Part C.

The principle of complementarity is reviewed with particular reference to its application to the study of slot transmission lines and slot aerials. The conventional techniques for making measurements on transmission lines are shown to be applicable to a two-slot line that is used to centre-drive a slot aerial. The complementary normalized impedance of such an aerial as a function of its half length, and the distribution of the electric and magnetic field along it, have been measured and are described. The experimental results for the slot aerial are compared with the approximately complementary ones derived theoretically for a centre-driven cylindrical aerial. The effect of the finite thickness of the earth screen in which the slot line and aerial are cut is discussed. A similar study is described for a three-element collinear array of slot aerials.

621.396.677.75

3109 A FLUSH-MOUNTED LEAKY-WAVE ANTENNA WITH PREDICTABLE PATTERNS. R.C.Honey.

I.R.E. Trans Antennas and Propagation, Vol. AP-7, No. 4, 320-9 (Oct., 1959).

Describes the design and the measured performance of a large flat aerial consisting of an inductive grid spaced over a conducting surface. The analysis employs the transverse-resonance method to determine the radiating properties of the structure. This analytical technique is shown to predict very accurately the amplitude and phase of the illumination along the aperture. An aerial was built with an 18- by 24-inch aperture and tested over the frequency band from 7 to 13 kMc/s. The results of these tests confirm the theoretical predictions in every detail. A pencil-beam from the aerial scans in the H-plan (perpendicular to the aerial) from 20° to 60° from the normal to the aperture as the frequency changes from 7 to 13 kMc/s. The H-plane beamwidth remains virtually constant over most of this band. The first H-plane sidelobe or shoulder is at least 29 dB below the main lobe from 7 to 10 kMc/s, and at least 23 dB below from 10 to 13 kMc/s. All H-plane sidelobes beyond three or four beamwidths on either side of the main lobe are at least 40 dB below the main lobe everywhere in the 7 to 13 kMc/s band. At the design frequency the measured pattern agrees with the theoretical pattern within a fraction of a dB down to 40 dB below the peak of the main lobe, even though the gain of the aerial at this frequency is only 33 dB.

621.396.677.75 : 538.56

3110 LEAKY-WAVE ANTENNAS.I. RECTANGULAR WAVEGUIDES. L.O.Goldstone and A.A.Oliner.

I.R.E. Trans Antennas and Propagation, Vol. AP-7, No. 4, 307-19 (Oct., 1959).

A microwave network approach is employed for the description and analysis of leaky-wave aerials. This approach is based on a transverse resonance procedure which yields the complex propagation constants for the leaky waves. A perturbation technique is then applied to the resonance equation to obtain results in simple and practical form. These procedures are illustrated by application

to a number of practical leaky rectangular waveguide structures. Very good agreement is obtained between theoretical results and measured values.

621.396.677.75 : 538.56

3111 CLOSELY-SPACED TRANSVERSE SLOTS IN RECTANGULAR WAVEGUIDE. R.F.Hyneman.

I.R.E. Trans Antennas and Propagation, Vol. AP-7, No. 4, 335-42 (Oct., 1959).

The travelling-wave modes associated with an infinite, periodic structure are considered. An appropriate equation for the propagation constants of these modes is derived through the use of Fourier analysis and an approximate application of the reaction concept. In the homogeneous case considered, it is found that two dominant modes may exist : an attenuated fundamental mode representing a perturbation of the dominant mode of a closed rectangular waveguide, and an unattenuated surface wave, which is similar to the wave associated with a corrugated surface waveguide. By means of the appropriate variation of physical parameters, including the slot length and spacing, essentially independent control of the attenuation constant and phase velocity of the fundamental mode is possible over a wide range. Typical curves of the propagation constants in terms of these parameters are given, and the results of experimental measurements are shown to be in close agreement with the theory.

621.396.677.75 : 538.56

3112 THE LAUNCHING OF SURFACE WAVES BY A PARALLEL PLATE WAVEGUIDE.

C.M.Angulo and W.S.C.Chang.

I.R.E. Trans Antennas and Propagation, Vol. AP-7, No. 4, 359-68 (Oct., 1959).

The excitation of the lowest TM surface wave in grounded dielectric slab by a terminated parallel plate waveguide is discussed. The ground plane is the continuation of the lower plate of the waveguide and the infinite dielectric slab is partially filling the waveguide. The thickness of the slab, the height of the parallel plate waveguide, and the frequency are such that only the lowest slow wave can propagate in the partially filled waveguide and the grounded dielectric slab. The Fourier transform of the field scattered by the termination of the upper plate of the waveguide is found by means of the Wiener–Hopf technique and the far fields obtained by the method of steepest descents. The percentage of power reflected back into the waveguide, of power transmitted to the surface wave in the slab, and of power radiated into the open space are plotted v. the thickness of the slab for different heights of the waveguide and $\epsilon = 2.49$. This method of excitation is found to be very efficient. If the dimensions of the waveguide and the slab remain within a considerably wide range, the efficiency obtained for a given frequency is very close to the optimum. Therefore, the adjustments for maximum efficiency are not critical.

621.396.677.81 : 535.31 : 538.56

3113 GENERALIZATIONS OF SPHERICALLY SYMMETRIC LENSES. S.P.Morgan.

I.R.E. Trans Antennas and Propagation, Vol. AP-7, No. 4, 342-5 (Oct., 1959).

The solutions of some spherically symmetric lens and lens-reflector problems recently treated by Kay (see Abstr. 5553 of 1959) are generalized. The original problem was to find a variable-index structure, with a point source at its surface or at infinity, which would produce a beam of finite angular width, having a prescribed variation of intensity with angle. It is shown that a prescribed exit beam can be obtained from a point source at any given distance from the lens, and that the index of refraction may be specified more or less arbitrarily in the outer part of the lens. A special case is solved in terms of tabulated functions.

621.396.677.83

3114 OPTIMUM ARRANGEMENT OF MICROWAVE PERISCOPES [PASSIVE REFLECTORS] IN RADIO-LINK SYSTEMS. P.Minzer.

Telefunken Ztg, Vol. 32, 269-78 (Dec., 1959). In German.

The following arrangements are examined: spherical radiator to circular passive reflector; spherical radiator to rectangular passive reflector; parabolic and square aerials to circular passive reflectors. The shape of the radiator and of the passive reflector has an effect only on the magnitude of the maximum efficiency of the system, the efficiency of the rectangular radiators being some 20-25% lower than that of the round radiators; however, the distance between the aerial and the passive reflector, for which this maximum was reached, remains unaltered. 28 references.

Z.F.Voyner

621.396.677.85

3115 CALCULATION OF LOSSES IN HYPERBOLIC LENSES ILLUMINATED BY A HERTZIAN DIPOLE.

I.F.Dobrovol'skii and V.P.Smirnov.

Radiotekhnika, Vol. 14, No. 12, 3-7 (Dec., 1959). In Russian.

The losses in lens aerials are mainly due to the reflections from the surface of the lens and to the heat losses in the material forming the lens. The heat losses are generally small, the large part of the losses occurring is due to scattering of the energy at the surface of the dielectric. By choosing the dielectric whose refraction coefficient lies in the region 1.4 to 2 losses due to scattering seldom exceed 25% even for values $f/D \cong 0.5$ at which the geometry of the lens is unfavourable.

Z.F.Voyner

621.396.679.4

3116 AERIAL EXCHANGES AT ADMIRALTY W/T STATION.

Engineer, Vol. 209, 258-9 (Feb. 12, 1960).

A system is described for connecting any one of several transmitters to different aerials according to the service to be provided, using motor-driven terminal carriages running in horizontal and vertical guides. An identical exchange has just been installed at Singapore, and an equivalent scheme for use with coaxial feeders is in the design stage.

621.396.679.4

3117 100 : 1 BANDWIDTH BALUN TRANSFORMER.

J.W.Duncan and V.P.Minerva.

Proc. Inst. Radio Engrs, Vol. 48, No. 2, 156-64 (Feb., 1960).

The theory and design of a Chebyshev tapered balun transformer which will function over frequency bandwidths as great as 100 : 1 is presented. The balun is an impedance matching transition from coaxial line to a balanced, two-conductor line. The transition is accomplished by cutting open the outer wall of the coaxial line, so that a cross-sectional view shows a sector of the outer conductor removed. As one progresses along the balun from the coaxial end, the open sector varies from zero to almost 2π, yielding the transition to a two-conductor line. The balun impedance is tapered so that the input reflection coefficient follows a Chebyshev response in the pass band. To synthesize the impedance taper, the impedance of a slotted coaxial line was obtained by means of a variational solution which yielded upper and lower bounds to the exact impedance. Slotted line impedance was determined experimentally by painting the line cross-section on resistance card using silver paint and measuring the d.c. resistance of the section. The measured v.s.w.r. of a test balun did not exceed 1.25 : 1 over a 50 : 1 bandwidth. Dissipative loss was less than 0.1 dB over most of the range. Measurements show that the unbalanced current at the output terminals is negligible.

621.396.679.4

3118 CABLE FOR TELEVISION AERIALS.

W.Thurl.

Radio Mentor, Vol. 25, No. 11, 882-5 (Nov., 1959). In German.

Review of the properties and requirements of aerial feeders. The transmission characteristics of coaxial and twin-wire cables at frequencies up to 800 Mc/s are examined with particular reference to the dielectric surrounding the wires and prevailing climatic conditions.

Z.F.Voyner

621.396.712.2

3119 PROGRAMME SWITCHING, CONTROL, AND MONITORING IN SOUND BROADCASTING.

R.D.Petrie and J.C.Taylor.

B.B.C. Engng Monogr., No. 28, 31 pp. (Feb., 1960).

Discusses factors which influence the choice of efficient and economical switching systems, and presents development of designs suitable for various densities and types of traffic which occur in the sound broadcasting system of the B.B.C. Details of inter-regional land-line or radio-link connections are not discussed.

PROPAGATION . INTERFERENCE

621.391.812.3

3120 INVESTIGATION OF RAPID FADING OF RADIO SIGNALS AT MEDIUM DISTANCES ALONG THE EARTH'S SURFACE. A.A.Semenov and G.A.Karpeev.
Radiotekhnika i Elektronika, Vol. 4, No. 2, 187-94 (Feb., 1959). In Russian.

An experimental investigation of the fading of 3 cm wave signals reflected from standard reflectors for surface propagation in the region of direct visibility was carried out. The fluctuation frequency, signal-amplitude distribution and effect of wind velocity were measured. The results show that there is no simple dependence of amplitude-fluctuation frequency on wind velocity and that in this frequency band the effects of reflection from ground covered by dense growth may be neglected. (English summary PB 141106T-13, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington D.C., U.S.A.). R.C.Glass

621.391.812.6

3121 PARTIAL REFLECTIONS IN THE ATMOSPHERE AND LONG-DISTANCE PROPAGATION.
F. Du Castel, P. Misme, A.Spizzichino and J.Voge.
Ann. Telecomm., Vol. 15, No. 1-2, 38-47 (Jan.-Feb., 1960). In French.

See Abstr. 3816-17, 6108 (1959). Most tropospheric scattering phenomena can be explained in terms of reflection from small horizontal layers (feuillets) in the atmosphere (a few km in extent and a few tens of m in thickness), in which the refractive index differs from the mean surrounding value. The reflection properties of such "feuillets" are calculated. The cases considered are : (1) where the reflecting surfaces is plane; (2) where the reflecting surface is irregular but where the layer has constant thickness — the treatment given is statistical; and (3) a qualitative discusssion of the case of irregular surface and varying thickness. G.D.Sims

621.391.812.6

3122 VARIATION IN THE DIMENSIONS OF SMALL ATMOSPHERIC LAYERS [FEUILLETS] AS A FUNCTION OF ALTITUDES. P.Misme.
Ann. Telecomm., Vol. 15, No. 1-2, 48-50 (Jan.-Feb., 1960). In French.

See also preceding Abstr. Upward directed winds cause vertical motion of the "feuillets" which according to the prevailing atmospheric conditions may either oscillate in position stably, perform unstable motions, or disrupt. The conditions for disruption correspond to those derived otherwise for the existence of turbulent motion. Formulae are given for factors affecting the linear dimensions of the "feuillets" and tables of values for the changes in dimensions to be expected when the height changes are given for various altitudes. G.D.Sims

621.391.812.6

3123 THE PRODUCTION OF WHISTLERS BY LIGHTNING. E.L.Hill.
Proc. Inst. Radio Engrs, Vol. 48, No. 1, 117-19 (Jan., 1960).

The correlation between lightning strokes and whistlers is briefly discussed, and it is suggested that conditions in the equalizing layer, above the storm area and below the ionosphere, play an important part in the production of whistlers. J.Dutton

621.391.812.62

3124 ANALYSIS OF 3 cm RADIO HEIGHT-GAIN CURVES TAKEN OVER ROUGH TERRAIN.
H.T.Tomlinson and A.W.Straiton.
I.R.E. Trans Antennas and Propagation, Vol. AP-7, No. 4, 405-13 (Oct., 1959).

Describes the effect of terrain and meteorological conditions on the height-gain pattern of 3.2 cm radio waves over various short transmission paths. Equivalent reflection coefficients are obtained and potential réflection areas are investigated. A study of the time variations in the height of nulls in the signal strength pattern is made and the relationship between movement of the nulls and the corresponding refractive index distribution is considered.

621.391.812.62

3125 SWEEP-FREQUENCY STUDIES IN BEYOND-THE-HORIZON PROPAGATION. W.H.Kummer.
I.R.E. Trans Antennas and Propagation, Vol. AP-7, No. 4, 428-33 (Oct., 1959).

Considers the bandwidth characteristics of the propagating medium in tropospheric beyond-the-horizon propagation. To study this problem, a frequency-sweep experiment was performed over a 171 mile experimental circuit. A 4.11 kMc/s transmitter was frequency modulated at a 1 kc/s rate over a 20 Mc/s band. The receiver was swept nonsynchronously over the same band at a 30 c/s rate. The resultant pulses were displayed on an oscillograph and photographed at the rate of one frame every 2 sec. The experiment used a 28 ft transmitting aerial and 8, 28 and 60 ft receiving aerials. Sequences of selected sweep-frequency pictures are shown for various aerial combinations and transmission conditions. The bandwidths from the experiment are compared with a calculation based on the common volume geometry. Photographs of signals received simultaneously from a twin-feed horizontal diversity system are also shown and discussed.

621.391.812.624

3126 A SCATTER PROPAGATION EXPERIMENT USING AN ARRAY OF SIX PARABOLOIDS. L.H.Doherty.
I.R.E. Trans Antennas and Propagation, Vol. AP-7, No. 4, 419-28 (Oct., 1959).

Using an aerial system whose aperture could be varied in four-foot steps between 4 and 24 ft, aperture-to-medium coupling loss measurements have been made at 2720 Mc/s on a 216 mile path. These measurements reveal an intrinsic variability in the scattering mechanism which is not accounted for in most current theories. Diversity and fading-rate measurements were also made. A simple mathematical model of the diffracted field yields calculated values of the normal component of the wind which agree well with the measured wind. Calculated and measured values of fading rate are also seen to be in good agreement. An estimate is made of the turbulent wind velocity.

621.391.812.624

3127 A NOTE ON SCATTER PROPAGATION. E.D.Denman.
Proc. Inst. Radio Engrs, Vol. 48, No. 1, 112-13 (Jan., 1960).

An experimentally verified theoretical study of the scattering of an electromagnetic wave by a periodic dielectric perturbation in the atmosphere indicates that, for a particular perturbation wavelength, a number of discrete values of electromagnetic wavelength exist for which maxima of the scattered amplitude may be expected. Assuming a dielectric turbulence spectrum varying as k^{-m} where k is the wave number, the ratio of the expected scatter powers for two differing electromagnetic frequencies is calculated. This ratio is plotted as a function of m and is found to be in qualitative accord with available experimental data. G.D.Sims

621.391.812.63 : 551.5

3128 INVESTIGATION OF THE SCATTERING OF RADIO WAVES AT METRIC WAVELENGTHS IN THE LOWER IONOSPHERE. T.Hagfors.
Geofys. Publ., Vol. 21, No. 2, 58 pp.(1959).

An outline is given of the experimental and theoretical knowledge on the scattering of metric waves in the lower ionosphere as observed over an oblique path. It is shown that there still is considerable disagreement on the question of the mode of propagation involved. Some workers ascribe most of the signal to reflection from meteor trails. Others believe in various types of scattering from electronic irregularities due to turbulence, and yet others maintain that partial reflections from gradients in mean electron density may explain the signal. The partial reflection theory is discarded as very improbable for theoretical reasons. The application of radio interferometer technique is then shown to be well suited for deciding whether turbulent scattering or meteor trail reflection is the dominant mechanism. This technique is applied to an 1180 km test circuit at 46.8 Mc/s, and it is shown that turbulent scattering is dominant in the continuous signal, but that a fraction of the continuous signal power is due to meteor reflections. The spatial power spectrum of electronic irregularities at a height of about 85 km is shown to follow approximately an inverse power law in the wavenumber k of the form k^{-3}. For the neutral gas this implies that wavenumbers $k < 0.35\ m^{-1}$ are probably within the "dissipation range" of the similarity region of the velocity spectrum of homogeneous turbulence. The typical r.m.s. turbulent velocity encountered is about 10 m/s, and the turbulence is approximately isotropic.

621.391.812.63 : 538.56

3129 AN IONOSPHERIC RAY-TRACING TECHNIQUE AND ITS APPLICATION TO A PROBLEM IN LONG-DISTANCE RADIO PROPAGATION. D.B.Muldrew.

I.R.E. Trans Antennas and Propagation, Vol. AP-7, No. 4, 393-6 (Oct., 1959).

A method is given for the determination of the equation of a ray path in a known ionosphere where there are no horizontal gradients. It can partially take into account the effects of the magnetic field of the earth. The method was applied to an oblique path between Ottawa and Slough (5300 km) to determine certain properties of the one-hop mode. From this it is shown that at times one-hop direct-ray propagation is possible over this path.

621.391.812.63 : 551.5

3130 ELECTRON DENSITIES OF THE IONOSPHERE UTILIZING HIGH-ALTITUDE ROCKETS.

O.C.Haycock, J.I.Swigart and D.J.Baker.
I.R.E. Trans Antennas and Propagation, Vol. AP-7, No. 4, 414-18 (Oct., 1959).

The problem of determining the electron densities in the E-region of the ionosphere is approached by using 6 Mc/s pulse transmissions from a rocket to several ground receiving stations. A logical and complete development, using dyadic techniques, is given for obtaining the propagation constant of the dissipative, anisotropic ionosphere. Special cases of the magneto-ionic formulae are given, and comparison of the ionosphere with a distributed-constant transmission line is made. In a nondissipative ionosphere, formulae are developed establishing the relationship between the effective electron density and the relative transmission delay of 6 Mc/s pulse. A description of the University of Utah's vertical incidence experiment is given in which a 6 Mc/s pulse from an airborne transmitter is received simultaneously at several ground receiving stations. The relative 6-Mc/s time-delay data from three Aerobee high-altitude rockets launched from Holloman Air Development Centre on July 1, 1953, November 3, 1953, and June 13, 1956, were obtained and, from these, electron density was calculated. Curves showing the profile of electron density as a function of altitude as calculated both during the rocket ascent and descent are presented. The curves indicate a general increase of electron density throughout the E-region, rising from nearly zero at 85 km to a maximum of about 2×10^{11} electrons/m^3. The maximum altitude attained by the rockets allowed exploration up to 137 km above sea level.

621.391.812.63 : 621.396.933.2 : 538.56

3131 THE EFFECTS OF IONOSPHERIC IRREGULARITIES AND THE AURORAL ZONE ON THE BEARINGS OF SHORT-WAVE RADIO SIGNALS. H.A.Whale.

J. atmos. terrest. Phys., Vol. 13, No. 3-4, 258-70 (Feb., 1959).

The nature of the observed variations in the received bearing of the signals from short-wave radio stations at various distances is discussed and the origins of some of the effects are suggested. The major part of the daily variation of bearing of stations up to about 15 000 km distant arises from the refraction of the ray in the F 1-region when it is reflected from the F 2-region. A discussion of the curving of the ray path by successive small changes of direction at each reflection point leads to the concept of an antipodal area replacing the geometrical antipodal point. The large changes in direction associated with the passage of a ray through the auroral regions suggest a method of plotting the shape of the absorbing parts of the auroral zone by observations at a place remote from this zone. A sample plot obtained by this method is presented.

621.391.812.63

3132 THE VELOCITY OF PROPAGATION OF AUDIO-FREQUENCY ELECTROMAGNETIC WAVES.

Ya.L.Al'pert and S.V.Borodina.
Radiotekhnika i Elektronika, Vol. 4, No. 2, 195-201 (Feb., 1959). In Russian.

The results of a determination of the phase velocity of propagation of e.m. waves in the 10-20 kc/s range are given. A method of harmonic analysis of atmospherics and their phase characteristics was used. Comparison of the results of theoretical calculations with experiment, taking into account the non-homogeneity of the ionosphere and the dependence of its conductivity on frequency, show good agreement. With decrease in frequency the phase velocity becomes larger than the velocity of e.m. waves in free space. The results enable the effective conductivity of the lower ionosphere to be determined. (English summary PB 141106T-13, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.). R.C.Glass

621.391.812.7

3133 THE EFFECT OF MULTIPATH DISTORTION ON THE CHOICE OF OPERATING FREQUENCIES FOR HIGH-FREQUENCY COMMUNICATION CIRCUITS. D.K.Bailey.

I.R.E. Trans Antennas and Propagation, Vol. 38, No. 4, 397-404 (Oct., 1959).

Harmful multipath distortion on h.f. facsimile services and telegraphic services operating at high speeds occurs when the received signal is composed of two or more components arriving by different modes over the same great-circle path with comparable intensities, but having travel times which differ by an amount equal to an appreciable fraction of the duration of a signal element. The dependence of multipath distortion on the relationship of the operating frequency of the m.u.f. is discussed and a new term, the multipath reduction factor (m.r.f.), is introduced which permits calculation in terms of the m.u.f. of the lowest frequency which can be used to provide a specified measure of protection against multipath distortion. The m.r.f. has a marked path-length dependence and is calculated as a function of path length for representative values of the other parameters involved by making use of an ionospheric model. It is then shown how the m.r.f. can be used in connection with world-wide m.u.f. prediction material to determine the minimum number of frequencies which must be assigned to a h.f. communication service of continuous availability operating at high speed. Some comparisons with observations are discussed, and finally conclusions are drawn concerning manner of operation and choice of operating frequencies to reduce or to eliminate harmful multipath distortion.

621.391.827.42 : 538.56

3134 IONOSPHERIC SELF-DEMODULATION AND SELF-DISTORTION OF RADIO WAVES. J.W.King.

J. atmos. terrest. Phys., Vol. 14, No. 1-2, 41-9 (April, 1959).

Experiments in which the phenomenon of ionospheric self-demodulation was investigated are described. Demodulation is observed to occur only at the lower modulation frequencies, and it is concluded that the occurrence of the phenomenon can be satisfactorily explained by an extension of Bailey's theory of ionospheric cross-modulation as presented by Huxley and Ratcliffe (Abstr. 3774 of 1949). The magnitude of the observed demodulation effect agrees with the value predicted by theoretical considerations and is what would be expected in view of results obtained in cross-modulation experiments. Complications due to selective fading were not present in the experiments performed. It is found that self-demodulation decreases as does ordinary cross-modulation, near dawn; this is explained by the fact that the absorption of the radio wave occurs at a level where the collision frequency is of the same order of magnitude as the equivalent angular frequency of the wave.

RADIO APPLICATIONS . RADAR

621.396.933.1 : 681.142

3135 A CATHODE-RAY-LABELLED PLAN DISPLAY. N.J.Smith and P.F.Heggs.

Proc. Instn Elect. Engrs, Paper 3246 E, publ. March, 1960, 4 pp. [Symposium on Data Handling and Display Systems for Air Traffic Control]. To be republished in Vol. 107 B (1960).

An account is given of a system for accepting extracted radar and associated information stored in either digital or analogue form and for displaying it on a cathode-ray tube as a plaque of characters marking the plan position of each track relative to an overlay or video map. A vector is added to denote the velocity and direction of each track. The characters are produced as brightened dots on a small raster centred on the track position. A good definition of character is achieved by a selection from 9×7 such as dots per character. The all-transistor pattern-generator described uses digital techniques throughout, and has ferrite-core storage. Experience with this generator shows that a 2 Mc/s element rate is suitable. Each track can be displayed in 360 microsec and hence 280 tracks can be displayed with a 10 c/s repetition rate.

621.396.933.2

3136 AN AUTOMATIC RADIO TRIANGULATION SYSTEM. R.F.Cleaver, P.Sothcott and F.J.Robinson.

Proc. Instn Elect.Engrs, Paper 3243 E, publ. March, 1960, 11 pp. [Symposium on Data Handling and Display Systems for Air Traffic Control]. To be republished in Vol. 107 B (1960).

Describes an automatic position-finding system for aircraft, making use of the signals radiated in the course of ordinary communication with the ground, and not requiring any special equipment

in the air. A network of automatic direction-finders on the ground feeds bearings to a control centre where they are displayed virtually instantaneously on a map. The operational requirements which have influenced the development of the system are discussed, and a brief reference to the history of position-finding by d.f. triangulation is followed by an account of the main technical features of the present system, with particular reference to the method of bearing transmission to the control centre and the problems of display. A practical approach to the planning of d.f. triangulation networks for specified accuracy and coverage is described, followed by details of some systems which have gone into service and of the methods used in testing them on signals from aircraft. Typical results are given. The paper concludes with an indication of the need for further development of display methods.

621.396.933.2

3137 ON THE THEORY OF AN INFRARED DIRECTION FINDER WITH CONICAL SCANNING. Yu.V.Pavlov.
Radiotekhnika, Vol. 14, No. 12, 50-7 (Dec., 1959). In Russian.

Expressions are obtained for the critical and angular sensitivities of an infrared direction finder of a modulated type with conical scanning. A formula is found for the equivalent aerial temperature appropriate to an infrared direction finder with any noise coefficient.
T.Horrocks

621.396.933.22

3138 THE MARCONI AUTOMATIC PLOTTER. D.W.G.Byatt.
Marconi Rev., Vol. 22, 215-24 (Fourth Qtr, 1959).

The plotter receives 25 c/s modulation from d.f. stations, transmitted over land lines by a carrier method. After phase discrimination, pairs of voltages are available to produce square waves which are integrated to generate bearing traces on a c.r.t. Up to six channels may be used and each trace may be offset to originate at a point corresponding to its d.f. station. The traces are displayed sequentially via a gating circuit and may be solid or dotted to distinguish stations on two frequencies.
W.G.Stripp

621.396.933.4 : 681.142

3139 A SURVEY OF DATA HANDLING FOR AIR TRAFFIC CONTROL. J.C.Farmer and M.F.Whitney.
Proc. Instn Elect. Engrs, Paper 3241 E, publ. March, 1960, 10 pp. [Symposium on Data Handling and Display Systems for Air Traffic Control]. To be republished in Vol. 107A (1960).

Gives a short description of the current methods of exercising air traffic control and attempts to bring out those problems, both current and future, which might be solved or eased by the application of electronic data processing and improved methods of data transfer. A review is then made of the new techniques and systems most likely to satisfy these requirements, and the manner in which the techniques described in the associated papers fit into the overall picture. Some indication is given of the extent to which these techniques have been or are being evaluated. The techniques examined will be those associated with the transmission of data, its storage, processing and display.

621.396.933.4 : 681.142

3140 AN EXPERIMENTAL SYSTEM FOR AUTOMATIC RADAR TARGET DETECTION AND DIGITAL CODED PLOT EXTRACTION AND TRANSMISSION. G.L.F.Hinckley.
Proc. Instn Elect. Engrs, Paper 3248 E, publ. March, 1960, 11pp. [Symposium on Data Handling and Display Systems for Air Traffic Control]. To be republished in Vol. 107B, (1960).

The system provides means for the automatic detection, extraction and digital encoding of the search plot data available from 2-dimensional radar equipments. Conversion from polar to Cartesian co-ordinates is effected, and the encoded Cartesian plot data are transmitted for remote use over long distances using a single telephone circuit. Full radar accuracy, resolution and data are maintained. The local or remote coded plot data are suitable for decoding and display or for direct insertion into a digital computer programmed for filtering, plot correlations into tracks, etc.

621.396.96 : 621.375.9

USE OF PARAMETRIC AMPLIFIERS AS LOW-NOISE RADAR RECEIVERS. See Abstr. 2985

621.396.963 : 681.142

3141 FIXED-COIL DISPLAY SYSTEM FOR DATA EXTRACTION. W.F.Ashton.
Proc. Instn Elect. Engrs, Paper 3245 E, publ. March, 1960, 6 pp. [Symposium on Data Handling and Display Systems for Air Traffic Control]. To be republished in Vol. 107 B (1960).

The development of data handling systems has demanded a rapid and accurate means of extracting radar data from p.p.i. displays. Possible systems include the use of mechanical aids, such as pantographs, and of electronically produced markers on the p.p.i. display which are capable of being positioned independently of the radar data. A fixed-coil display system using the latter method is described. The system uses a centrally generated linear time-base which is resolved into sine and cosine components to produce the trace on a display in the direction of look of the aerial system. Each display console can accept two voltage inputs in each of the orthogonal coordinates, and a diode clamp switch is used to feed each in turn to the deflection amplifier and coils. These inputs normally accept the time-base and inter-trace marker input. To obtain accurate registration between the marks produced on the cathode-ray-tube face by equal voltages fed to the two inputs, d.c. level setting and gain equalization are needed. As an example of the use of the display system, the tracker's display of an experimental data extraction system is described. One of the most intractable problems met was "spot wander". This name is given to the effect where an inter-trace marker, positioned by steady deflection voltages, moves in position on the cathode-ray tube in sympathy with the deflection waveform fed to the other input of the console. Several causes were discovered and the effect was reduced to acceptable levels. Further development work to improve the accuracy of the system has been carried out. To achieve accuracy of registration an automatic zero control system is used, and an overall stability of registration at zero voltage of 1 part in 5000 has been obtained. A secondary source of error was in the nonlinearity of the magslip resolver circuit. This was of the order of 1 part in 1000. However, by means of certain circuit improvements a linearity through the resolver of about 1 part in 5000 has been achieved.

621.396.965.8 : 681.142

3142 METHODS OF EXTRACTING RADAR DATA FOR AUTOMATIC PROCESSING. N.J.Smith and B.W.Oakley.
Proc. Instn Elect. Engrs, Paper 3244 E, publ. March, 1960, 3 pp. [Symposium on Data Handling and Display Systems for Air Traffic Control]. To be republished in Vol. 107 B (1960).

Two alternative approaches to the problem of converting radar signals into a form suitable for use in digital computers are considered and the problems discussed. One is automatic extraction and track production, and the other is manual, but based on the use of computer aids to enhance the operator's efficiency and reliability. Possible solutions are outlined and some difficulties which need to be overcome are explained. The two methods are then compared from the point of view of a potential user and it is shown that, when reasonably developed, each method has advantages. The relative advantages of the two approaches show up differently under different requirements and the choice must therefore be made in the light of a particular set of present and future requirements. It is also suggested that the choice is not always clear-cut. Automatic tracking systems may need human assistance in some circumstances and manual systems may be successively more assisted by a computer.

621.396.965.8 : 681.142

3143 SEMI-AUTOMATIC FLIGHT CONTROL USING EXTRACTED RADAR DATA. C.C.Fielding and J.G.Gibbs.
Proc. Instn Elect. Engrs, Paper 3247 E, publ. March, 1960, 4 pp. [Symposium on Data Handling and Display Systems for Air Traffic Control]. To be republished in Vol. 107 B (1960).

Improved accuracy of radar data coupled with the advent of digital data handling methods and improved communication facilities via digital ground/air data links could enable a major step forward to be made in the field of detailed flight control of aircraft. The requirements which already exist and are foreseen for flight control are examined, and some of the advantages to be gained are indicated. A review follows of how digital data processing techniques can be applied to solve many of the problems. An indication is given of the relationship and optimum balance between man and machine. Finally, information is given on the accuracy which can be expected from an up-to-date system.

621.396.967

3144 AN 8 mm HIGH-RESOLUTION RADAR INSTALLATION. J.M.G.Seppen and J.Verstraten.
Philips tech. Rev., Vol. 21, No. 3, 92-103 (1959-60).

This installation is distinguished from the more familiar and widely used 3 cm radar systems by its higher resolution. This is due

to the fact that with a shorter wave-length a shorter pulse length (0.02 μsec) and narrower angular beam width (0.3°) can be obtained. The narrower beam calls for a higher pulse repetition frequency. In view of the short pulse length it was necessary when designing the modulator to keep the stray capacitances as small as possible. A pulse-correcting network is incorporated to ensure a good reflected pulse shape under all circumstances. Some p.p.i. photographs illustrate the results obtained.

621.396.969 : 551.5

3145 THE ASSOCIATION OF VISIBLE AURORAL FORMS WITH RADAR ECHOES. G.F.Lyon.
Canad. J. Phys., Vol. 38, No. 3, 385-9 (March, 1960).

A peak in 48.2 Mc/s echo occurence is observed at Saskatoon corresponding in time to the period of breakup of quiet arc into active rayed strucutres. this is also the time of most frequent occurence of characteristic "Curl" forms in the aurora. If, as Gartlein suggests, the "Curl" forms are formed by instabilities in a sheet beam then the primary particles are positively charged.

621.396.969 : 551.5

3146 AN ANALYSIS OF SOME STATISTICAL PROPERTIES OF AURORAL RADAR REFLECTIONS AND THEIR RELATIONSHIPS TO THE DETECTION CAPABILITIES OF THE RADAR. A.G.McNamara.
Canad. J. Phys., Vol. 38, No. 3, 425-38 (March, 1960).

A statistical model of auroral echo occurrence has been made from an analysis of observations at 48.5 Mc/s obtained over a number of years of continuous operation. The probability density distribution of auroral target cross-sections (σ) has been examined experimentally, and the resulting curve fitted by simple mathematical relations. Both an inverse power law and an exponential law have been derived, of the forms

$$p(\sigma)d\sigma = k\sigma^{-1.67}d\sigma$$

and

$$p(\sigma)d\sigma = \frac{1}{\sigma m}e^{-\sigma/\sigma m}d\sigma.$$

These models have been interpreted in terms of distributed and localized targets, and used to analyse the echo occurrence indices and the effect which variation of radar parameters will have upon them. Both forms of the target law are useful although it is considered that the exponential form yields better agreement with observations over a wider range of the variables.

621.396.97

3147 PLANNING AND INSTALLATION OF THE SOUND BROADCASTING HEADQUARTERS FOR THE B.B.C.'S OVERSEAS AND EUROPEAN SERVICES. F.Axon and O.H.Barron.
Proc. Instn Elect. Engrs, Paper 3213 E, publ. April, 1960. 12 pp. To be republished in Vol. 107 B (1960).

Following a brief history of the B.B.C.'s external services, the reasons for the present form of centralization at Bush House are outlined. The method of programme building is considered and the studio and recording facilities are detailed. The equipment in the control room and other technical areas is described.

TELEVISION

621.397.132

3148 A REVIEW OF COLOUR TELEVISION IN THE U.K. R.D.A.Maurice.
Electronic Engng, Vol. 32, 68-73 (Feb., 1960).

621.397.23

3149 REDUCTION OF TELEVISION BANDWIDTH BY FREQUENCY-INTERLACE. E.A.Howson and D.A.Bell.
J. Brit. Instn Radio Engrs, Vol. 20, No. 2, 127-36 (Feb., 1960).

A method analogous to the N.T.S.C. colour television system is used to obtain a bandwidth reduction of a black-and-white video signal by a factor of approximately 2 : 1. The normal signal is split into two frequency bands, nominally zero to 1.5 Mc/s and 1.5 to 3.0 Mc/s. The latter is used to amplitude-modulate a sub-carrier, whose frequency is an odd multiple of half the line scanning rate. The lower sideband of the modulator output is selected and combined with the original zero-to-1.5 Mc/s band, so that the spectra of the two signals interleave. The combined signal may now be sent over a channel of 1.5 Mc/s nominal bandwidth. At the receiving end of the channel the composite signal is applied to a synchronous demodulator, fed also with sub-carrier of the same frequency as at the transmitter. The lower sideband of this demodulator is taken and combined with the received signal, to yield a "normal" video signal extending from zero to approximately 3 Mc/s. together with an "interleaved" signal. The interleaved signal is such as to give an interference pattern on the display which in a stationary picture should optically cancel after four successive frame scans. However, the pattern is built up in such a way as to give rise to a "crawling" motion which is very noticeable at close viewing distances. Photographs of typical pictures obtained with an experimental apparatus are given, showing various interference effects produced.

621.397.331.24

3150 MONOCHROME REPRODUCTION OF COLOUR T.V. SIGNAL. R.D.A.Maurice.
Electronic Technol., Vol. 37, No. 3, 116-19 (March, 1960).

It is shown that in a colour-television system, using the standard N.T.S.C. method of gamma correction, the deterioration in orthochromatism of the monochrome compatible picture can be reduced by the presence of the dot pattern due to the chrominance sub-carrier. A "notch" or sub-carrier elimination filter is thus undesirable in monochrome receivers. In the case of a true constant luminance type of N.T.S.C. system the presence of the chrominance signal on the monochrome screen is deleterious although the deterioration caused by it is by no means as great as the improvement to be obtained from its presence in the case of the standard N.T.S.C. system. A black-to-blue transition is taken to illustrate these effects and one or two others of a transient nature.

621.397.332 : 621.373.431

3151 SYNCHRONIZING TWO SINUSOIDAL VOLTAGES OF NEARLY EQUAL FREQUENCY FOR SCANNING PICTURE TUBES. C.Curie and B.Cazeneuve.
C.R. Acad. Sci. (Paris), Vol. 250, No. 3, 491-3 (Jan. 18, 1960). In French.

Description of a scanning method for closed-circuit television systems based on Lissajou figures obtained by using two sinewave signals of approximately equal frequency. Both frequencies are derived from a single quartz oscillator by means of frequency division. Circuits are presented for a scanning system operating on 30 pictures per second and using scan frequencies of 16200 c/s and 16170 c/s. This is claimed to give a definition comparable to that obtained in commercial television. B.Dentskevich

621.397.335 : 621.373.444

3152 COLOUR-BAR GENERATOR FOR THE N.T.S.C. SYSTEM. G.Bolle.
Telefunken Ztg, Vol. 32, No. 237-43 (Dec., 1959). In German.

After a brief discussion of the N.T.S.C. system and the composition of a colour-bar pattern for test purposes, the principle of a versatile precision instrument is described. After the conventional generation of the line sync., colour burst and the relevant blanking pulses, a switch-key arrangement enables the selection of any of the available colour bars which are generated by a chain of monostable multivibrators. These are locked in such a way that the trailing edge of the first univibrator will fire the next, so that any colours or sequence of colours can be chosen for display. Circuit diagrams, waveforms and typical oscillograms of the essential parts of the colour bar generator are reproduced and described in detail. The accuracy is indicated by the transit time from bar to bar (< 0.2 μsec) and by the phase fidelity of the chrominance subcarriers ($\Delta\varphi < 1°$). A.Landman

621.397.6

3153 A TELEVISION LINE SELECTOR. H.Wolf.
Nachrichtentech. Z. (N.T.Z.), Vol. 12, No. 5, 239-42 (May, 1959). In German.

Differentiated frame synchronizing pulses are used to trigger a cathode-coupled multivibrator which produces a pulse with a duration variable from 3 to 14 ms. The trailing edge of the pulse is used to trigger a similar circuit. A third stage produces a pulse with duration variable from 70 to 200 μsec, and this is differentiated to trigger the oscilloscope. To eliminate jitter, the trailing edge of the second stage is synchronized by a line pulse from the separator. A circuit and photographs of oscillograms are given. W.G.Stripp

621.397.612

3154 SUPERVISION AND CONTROL OF TELEVISION TRANSMITTERS. J.W.H.van Dijk.

Philips telecomm. Rev., Vol. 21, No. 1, 1-12 (Aug., 1959).

Maintenance of a high standard of picture transmission requires the provision of ample testing facilities. These are obtained from a video test rack which supplies a number of square-wave and saw-tooth signals and a standard test picture signal. Test results are displayed on a high-grade picture monitor which is also used for normal monitoring. For comprehensive installations a separate control desk is available, but for the smaller type of installation all controls can be concentrated on a small panel mounted in one of the transmitter cabinets. A number of details of the power interlocking circuits are given.

621.397.62

3155 AN INSTRUMENT FOR SUBJECTIVE TEST OF TELEVISION RECEIVERS. H.F.Leigemann.

Telefunken Ztg, Vol. 32, 244-50 (Dec., 1959). In German.

A special test equipment is described whereby two images on the same screen can be visually compared, the first being displayed on the top half, the second on the bottom half of the display tube. The principle consists of extracting the video signals at the tube cathodes of the two receivers under test and feeding them via two amplifiers having individual adjustable brightness- and contrast-controls to an electronic switch which connects the inputs alternately to the display tube. The separation line can be moved up and down the superimposed image by simple adjustment of the keying potential in the switching circuit. Non-detailed circuit diagrams of the amplifiers, the pulse generator and the switch are shown and briefly described. A.Landman

621.397.73

3156 MICROWAVE TELEVISION MOBILE RELAY FOR OUTSIDE BROADCASTING. J.Polonsky.

J. Brit. Instn Radio Engrs, Vol. 20, No. 2, 91-102 (Feb., 1960).

A brief account is given of the principal qualities required in mobile links. These include transmission of picture and sound without degradation of the quality and stability in time of the technical performances, and ease of operation as regards transport, installation, monitoring and maintenance. The essential causes of distortion introduced in the transmission by a microwave link are reviewed and the problem of cross-talk between picture and sound channels and the transmission of a colour television programme are dealt with in some detail. A short description is given of an equipment operating in the band 6400-6900 Mc/s.

621.397.9

3157 THE EQUIPMENT OF THE B.B.C. TELEVISION FILM STUDIOS AT EALING.

B.B.C. Engng Monogr., No. 27, 31 pp. (Jan., 1960).

Describes the operations which are involved and the facilities provided at these studios. Descriptions of the technical equipment and areas are included, together with some discussion on the differences between cinema film production methods and television film operations.

621.397.9 : 621.389

3158 TIME LAPSE ULTRAVIOLET TELEVISION-MICROSCOPY INSTRUMENTATION AND BIOLOGICAL APPLICATIONS. G.Z.Williams.

I.R.E. Trans Med. Electronics, Vol. ME-6, No. 2, 68-74 (June, 1959).

The exposure of biological specimens is reduced by allowing the image on a Vidicon screen, following a short ultraviolet flash, to build up to its full extent before scanning with the electron beam. A single frame is then photographed by a synchronously-operated camera. A special Vidicon tube having five times the sensitivity of ordinary tubes to ultraviolet rays is employed, and it is possible to take cine recordings over a period of 1 hr for some biological specimens. Examples of the application including the study of enzyme function and cell structure are given. F.T.Farmer

621.397.9

3159 SCANNING MICROSCOPY IN MEDICINE AND BIOLOGY. L.E.Flory.

Proc. Inst. Radio Engrs, Vol. 47, No. 11, 1889-94 (Nov., 1959).

Scanning microscopy provides the means for extending the range of usefulness of the light microscope in several directions. In addition to the convenience of viewing a large bright image on the television type monitor, it can also enhance the contrast of faintly visible specimens and can extend the convenience of direct observations into the infrared and ultraviolet. By electrical processing of the video signal, a great deal of quantitative information can be extracted. This method has been used to determine the number, size, and size distribution of particles in a field and to quantitate absorption of biological materials for visible and ultraviolet light.

CONTROL . DATA PROCESSING

CONTROL AND SERVO SYSTEMS

621-52

3160 LIST OF U.S.S.R. AND FOREIGN LITERATURE ON AUTOMATIC CONTROL AND SIMILAR PROBLEMS FOR 1956.

Avtomat. i Telemekh., Vol. 20, No. 3, 381-99 (1959). In Russian.

621-52

3161 CONVERSION OF THE INITIAL CONDITIONS AT THE OUTPUT OF A LINEAR SYSTEM WITH VARIABLE PARAMETERS INTO AN EQUIVALENT INPUT SIGNAL. A.V.Solodov.

Avtomat. i Telemekh., Vol. 19, No. 7, 654-60 (1958). In Russian. English summary: PB 141096T-7, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

Formulae to convert initial output conditions into an input signal are deduced. The input signal is a combination of various order δ-functions. The formulae obtained are used to determine the output transient process when the pulse transient function is known, the output process being caused by the initial conditions mentioned above.

621-52

3162 THEORY OF THE STRUCTURE OF HIGH-SPEED AUTOMATIC CONTROL SYSTEMS. M.V.Meerov.

Avtomat. i Telemekh., Vol. 19, No. 7, 621-32 (1958). In Russian. English summary: PB 141096T-6, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

The structure under consideration permits, in principle, the reproduction of any degree of accuracy. It is shown how to take into account some limitations due to nonlinear characteristics of some units.

621-52

3163 THE THEORY OF MULTIPLE CONTROL. H.Becker.

Regelungstechnik, Vol. 7, No. 4, 133-4 (Jan. 7, 1959). In German.

The general approach to the problem of multi-variable control systems made by Kavanagh (Abstr. 5640 of 1957) is investigated for a special case. Two multipole circuits are connected in tandem and the output of the second is connected back into the first. The essential problem is that of realizability. A formal solution is obtained. S.C.Dunn

621-52

3164 PLOTTING OF ROOT LOCI OF AUTOMATIC CONTROL SYSTEMS. N.N.Mikhailov.

Avtomat. i Telemekh., Vol. 19, No. 7, 661-73 (1958). In Russian. English summary: PB 141096T-7, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

Deals with analytical, graphical and semigraphical plotting of the root loci and the use of root-finders is suggested. The possibility of plotting with automatic devices is stated and block diagrams of these devices are given.

621-52

3165 SYNTHESIS OF A CLASS OF OPTIMUM CONTROL SYSTEMS. R.Kulikowski.

Bull. Acad. Polon. Sci. Ser. Sci. tech., Vol. 7, No. 11, 663-71 (1959).

The class of control systems is that in which a control signal of bounded amplitude is applied to the linear non-changeable element (that is the output amplifier, motor and load) having a given transient function. It is required to find the optimum control signal which gives a minimum response-time. The synthesis of this class of optimum systems for the case where only a small number of derivatives are to be specified in the output, has already been considered [A.A.Feldbaum, Moscow (1955)]. In this paper a synthesis procedure is given which is valid for all derivatives. An example is given of the synthesis of a simple circuit and it is stated that the method may be extended to a power-bounded control signal. S.C.Dunn

621-52

3166 ELECTROPNEUMATIC TRANSDUCERS. Yu.V.Krementulo.

Avtomat. i Telemekh., Vol. 20, No. 2, 211-19 (1959). In Russian.

Deals with electropneumatic transducers developed in the Institute of Automation and Telemechanics of the Academy of Sciences of the U.S.S.R. Block diagrams, methods of operation and experimental results are presented for two types of transducers. The first uses a position-control system with a two-phase motor, to actuate, through a cam, the nozzle and baffle arrangement of the pneumatic system. The second uses a moving coil and permanent magnet. Both transducers use two pneumatic amplifiers with negative feedback. The errors due to nonlinearity of the characteristic of the primary pneumatic amplifier are determined and the problems relating to the gain of the secondary pneumatic amplifier are considered. Calculations of a temperature compensation circuit are also presented. B.Dentskevich

621-52

3167 JET ENGINE CONTROL UTILISING ELECTRONIC EQUIPMENT. H.E.Coles.

Elect. Rev., Vol. 166, No. 2, 47-50 (Jan. 8, 1960).

Outlines some of the principles which govern the choice of control system and indicates how these controls have been evolved. J.T.Hayden

621-52 : 621.317.73

3168 AN EXPERIMENTAL TRANSISTOR-CONTROLLED COMPONENT SELECTION AND TESTING MACHINE. T.C.Cardwell, J.R.W.Smith and G.H.King.

Proc. Instn Elect. Engrs, Paper 3219 M, publ. April, 1960, 6 pp. To be republished in Vol. 107B (1960).

Shows the need for a selection and testing machine in the light of recent developments in the automatic assembly of components on to printed-wiring boards. The advantages of a programmed machine are given and the flexibility and simplicity obtained are illustrated. The general operation of the machine is outlined. Examples of the method of coding and the technique of programming on to punched-paper tape are included. The build-up of the electronic control from a number of relatively simple basic circuits is shown. Finally, the range of components handled, details of the test bridges, and the overall speed and reliability are given.

621-52

3169 ELECTRO-ACOUSTIC CONTROLLER FOR REGULATING THE CHARGING OF BALL MILLS WITH MATERIAL. V.S.Beroza.

Priborostroenie, 1959, No. 2 (Feb.). In Russian. English translation in: Instrum. Constr., 1959, No. 2, 3-7 (Feb.).

621-52 : 621.77

3170 STATISTICAL ESTIMATION OF AUTOMATIC CONTROL OF MILLING IN A BALL MILL. V.Sh.Bereza.

Avtomat. i Telemekh., Vol. 20, No. 2, 150-60 (1959). In Russian.

621-52 : 621.317.7

3171 INSTRUMENTATION AND CONTROL OF NUCLEAR REACTORS. P.Bonnaure.

Onde elect., Vol. 38, 575-82 (Aug.-Sept., 1958). In French.

A description is given of measuring and control equipment. Apparatus for the measurement of power output and activity, as well as the detectors of faults in the sheaths, are examined in greater detail.

621-52 : 621.317 39

3172 NEW INSTRUMENTATION CONCEPTS FOR MANNED FLIGHT. L.J.Fogel.

Proc. Inst. Radio Engrs, Vol. 47, No. 11, 1978-92 (Nov., 1959).

The advent of modern aircraft has forced the recognition of three fundamental principles required to optimize human flight control: the first, kinalog attitude display, is an adaptive kinesthetic analog tracing the human orientation as g force is sensed, intended to inhibit the onset of vertigo through the maintenance of continued agreement between the instruments and the human operator's internal "up" vector. The second, anticipatory display, describes information relative to some aspect of a future status of the vehicle, thus overcoming both the pilot's and the vehicle's response time lag. The speed of modern aircraft already leaves too little time for decision making. Anticipatory display may overcome this problem and significantly improve performance. The third, modified pictorial display, presents an integrated pictorial view from which has been removed much of the irrelevant data which would be seen in the real world. These concepts are embodied in proposed aircraft instrument designs which fall within the present state of the art. They are also extended to possible future spacecraft applications. Compatible quantitative instrumentation is also described to complete the cockpit panel. Cursory evaluation has been accomplished by ground simulation and some relevant data is presented. These initial experiments appear to offer a significant promise to increase the performance capability of future manned vehicles.

621-526

3173 DYNAMICS OF AN ELECTRIC RELAY SERVOMECHANISM WITH THE LOAD CHANGING PROPORTIONALLY TO MOTION. N.S.Gorskaya.

Avtomat. i Telemekh., Vol. 19, No. 6, 540-57 (1959). In Russian. English summary: PB 141096T-5 obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

Motion of the servomechanism is described by a complete second-order differential equation. The right-hand side of the equation gives a relay function with a loop and a dead zone. A complete solution of this nonlinear problem using the point conversion method is given.

621-526

3174 THE STABILITY OF PERIODIC CONDITIONS IN AUTOMATIC CONTROL SYSTEMS FOUND APPROXIMATELY ON THE BASIS OF FILTER HYPOTHESIS. V.A.Taft.

Avtomat. i Telemekh., Vol. 19, No. 6, 558-63 (1958). In Russian. English summary: PB 141096T-5, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

An approximate method of analysis of periodic conditions in nonlinear control systems is outlined. This method is briefly compared with that based on the autoresonance hypothesis.

621-526

3175 THE STABILITY OF PERIODIC CONDITIONS IN NONLINEAR SYSTEMS WITH PIECE-WISE LINEAR CHARACTERISTICS. M.A.Aizerman and F.R.Gantmakher.

Avtomat. i Telemekh., Vol. 19, No. 6, 606-8 (1958). In Russian. English summary: PB 141096T-5, obtainable from Office of Technical Services, U.S. Dept of Commerce, Washington, D.C., U.S.A

621-526

3176 ON THE STABILITY OF A NONLINEAR EQUILIBRIUM SEEKING CONTROL SYSTEM. L.I.Kupriyanova.

Avtomat. i Telemekh., Vol. 20, No. 2, 127-34 (1959). In Russian.

The behaviour of an equilibrium seeking regulating system due to time changes of the parameters determining the equilibrium position is solved on the basis of the second Liapunov method. This is based on the fact that nonlinear systems with variable coefficients can be analysed as nonlinear systems with constant coefficients considered in fixed time intervals. The analysis of transient stability is carried out by investigating the system stability for each fixed interval of time. From the equations of the system three inequalities are derived which relate the coefficients of the system. When plotted these define the regions of stability. B.Dentskevich

621-526

3177 ON THE STABILITY OF RELAY SYSTEM EQUILIBRIUM. D.V.Anosov.

Avtomat. i Telemekh., Vol. 20, No. 2, 135-49 (1959). In Russian.

A closed-loop system involving a linear part (described by a linear differential equation with constant coefficients) and one nonlinear element (a relay) is considered. An accurate mathematical treatment is given and the criteria for the equilibrium stability are derived. These are in agreement with those derived in previous work which considered the limiting case using an ideal relay. In the present analysis the relay need not have an infinitesimally short switching time. B.Dentskevich

621-526

3178 STABILITY CRITERIA FOR INSTRUMENT SERVOMECHANISMS WITH COULOMB FRICTION AND STICTION. M.P.Pastel and G.J.Thaler.
Trans Amer. Inst. Elect. Engrs II, Vol. 78, 294-7 (1959) = Applic. and Industr., Vol. 45 (Nov., 1959).

Using a phase-plane analysis, the step-function response of a second-order servo with Coulomb friction is examined. Ramp-function response in the case of Coulomb friction together with discontinuous stiction is similarly treated and stability criteria are derived for these cases and for the case where the ramp function is suddenly applied. Phase trajectories for these cases are given. In conclusion the effects of changes in input velocity and variable stiction are considered. G.D.Sims

621-526

3179 COUPLED TWIN-DRIVE SERVOSYSTEMS. P.F.Klubnikin.
Avtomat. i Telemekh. Vol. 20, No. 2, 161-75 (1959). In Russian.

The theory is developed for parallel combinations of open-loop and closed-loop systems as well as for several closed-loop systems. This is claimed to give substantial improvements in the frequency passband, transient response, and dynamic accuracy. The outputs of the two systems are coupled through a differential gear. Three cases are presented: (a) a regulator system; (b) position control; (c) an acceleration-lag system. Transfer functions and error coefficients of the systems mentioned are obtained and experimental results of tests carried out to verify the analysis are presented. B.Dentskevich

621-526

3180 CHOICE OF OPTIMUM GAIN COEFFICIENT IN A CONTROL SYSTEM WITH A SELF ADJUSTING PROGRAMME. I.I.Perel'man.
Avtomat. i Telemekh., Vol. 20, No. 2, 184-91 (1959). In Russian.

A system, which is subjected to a repetitive disturbance with a stochastic distribution, is analysed. The gain of the adjusting mechanism is optimized to minimize the mean-square error. The presence of white noise at the input is also considered. The analysis is confined to systems with low-inertia regulators and load. One of the applications of such systems is in mills for hot-rolled steel strip. B.Dentskevich

621-526

3181 SYNTHESIS OF THE CONTROL UNIT OF A SERVOSYSTEM WHICH IS OPTIMUM FROM THE POINT OF VIEW OF ITS HIGH-SPEED. Sun Tsjan [Sung Tsuan].
Avtomat.i Telemekh., Vol. 20, No. 3, 273-88 (1959). In Russian.

The system is described with the third-order differential equation. Approximation of the surface under consideration is explained. The control unit is developed that provides almost optimum transient processes. Experimental results are presented.

621-526

3182 DETERMINATION OF THE OPTIMUM WEIGHTING FUNCTION OF PULSE SERVOSYSTEMS. V.P.Perov.
Avtomat. i Telemekh., Vol. 20, No. 3, 289-97 (1959). In Russian.

621-526

3183 CHOICE OF NONLINEAR SPEED FEEDBACK CHARACTERISTIC OF A POSITION SERVOSYSTEM. B.N.Naumov.
Avtomat. i Telemekh., Vol. 20, No. 3, 335-45 (1959). In Russian.

621-526

3184 A CALCULATION OF SWITCHING FUNCTIONS AS A MEANS OF MINIMIZING ERROR IN AN ON-OFF CONTROL SYSTEM. R.F.Brown.
Proc. Instn Elect. Engrs, Monogr. 370M, publ. April, 1960, 8 pp. To be republished in Part C.

Self-optimization of control systems is becoming a practical proposition through new developments in the electronics field, notably in digital-computer techniques. After discussion of some essential basic concepts, an adaptive switching function as an on-off controller is proposed. Results are given for repeated application of step and ramp inputs to a mathematical model of an ideal servomechanism, set up on a Deuce digital computer. The results neglect relay imperfections, they are preliminary in nature, and intended to provoke further research.

621-526

3185 ON THE SYNTHESIS OF MULTILOOP SYSTEMS. J.D.Glomb.
Proc. Inst. Radio Engrs, Vol. 48, No. 2, 245-6 (Feb., 1960).

A method of analysis is described using the root-locus technique, which allows prediction of root loci for certain simple multi-loop systems. The method depends on simplifying the systems by holding the ratios of certain parameters constant and then finding the root loci for their individual (but synchronized) variation. T.Horrocks

621-52

3186 APPROXIMATION METHODS FOR APERIODIC TRANSFER CHARACTERISTICS. V.Strejc.
Regelungstechnik, Vol. 7, No. 4, 124-8 (Jan. 7, 1959). In German.

The fact that the transient response of many process controllers is monotonic means that they can be approximated very frequently by simplified equivalent circuits. Previous methods have used a representation involving a first-order network and a time delay. The new proposal is to use a higher-order network with equal time-constants. A method is described applicable to control systems which have a second-order transfer function which allows these equal time-constants to be determined with sufficient accuracy. S.C.Dunn

621-52

3187 THE SIGNIFICANCE OF THE HIGHER DERIVATIVES OF A CONTROLLED QUANTITY IN A CONTROL CIRCUIT WHICH IS SUDDENLY DISTURBED. M.Mesarović.
Regelungstechnik, Vol. 7, No. 4, 128-32 (Jan. 7, 1959). In German.

Control loops are classified in five groups according to the nature of the controlled plant and the location of the disturbance. The influence of the derivative on the stabilization of the system depends on the order of the time lags present. It is pointed out that under certain conditions the influence of the commonly applied first derivative can be detrimental if the system is of a high order. The possibilities are discussed of designing controllers which can give optimum adjustment by introducing higher derivatives. S.C.Dunn

621-526

3188 THE RESPONSE OF A LOADED HYDRAULIC SERVOMECHANISM. D.E.Turnbull.
Proc. Instn Mech. Engrs, Vol. 173, No. 9, 270-84 (1959).

When a hydraulic servo controls the position of a load the force required to move the load is produced by a pressure drop across the actuator. This pressure drop decreases that available to drive fluid through the control ports of the valve with the result that the speed of response is reduced. The effects of various types of load on the dynamic behaviour of the system for both step and sinusoidal input signals are examined. Analytical solutions to most of the response equations are obtained but graphical methods are occasionally used. When an inertial load is present it has been found necessary to consider the step response in the velocity–displacement or "phase" plane.

621-526

3189 THE APPLICATION OF LINEAR SERVO THEORY TO THE DESIGN OF A.G.C. LOOPS. W.K.Victor and M.H.Brockman.
Proc. Inst. Radio Engrs, Vol. 48, No. 2, 234-8 (Feb., 1960).

An analytical technique for designing automatic gain control circuits is presented. This technique is directly applicable to high-gain high-performance radio receiving equipment. Use of this technique permits the performance of the a.g.c. system to be specified completely with respect to step changes in signal level, ramp changes in signal level, frequency response, receiver gain error as a function of receiver noise, etc., before the receiver is constructed and tested. When used in conjunction with the statistical filter theory the technique has been used to synthesize optimal a.g.c. systems when the characteristics of the signal and noise are appropriately defined. The mathematical derivation of the closed-loop equations is presented. The resulting expressions are simple and easy to understand. The underlying assumptions used in theory were tested experimentally and close agreement was found.

621-526

3190 DYNAMICS OF AUTO PILOT WITH PULSED SERVOMECHANISM. I.N.Krutova.
Avtomat. i Telemekh., Vol. 20, No. 2, 115-26 (1959). In Russian.

The system considered is that of a servomotor driven at a

constant speed. It can be coupled to the output shaft through electromagnetic clutches and gearing which provide rotation of the output shaft in either direction. The servoloop incorporates a pulse circuit which uses the error signal to control the on-off ratio of the relays energizing the electromagnetic clutches. Two examples are analysed: (1) when the servomechanism motion is described by the first order differential equation; and (2) when it is described by the second order equation. These correspond respectively to the cases when the moment of inertia of the moving parts coupled to the output shaft is zero and when it is non zero. The analysis yields parameter relations that characterize the stability limits.

B.Dentskevich

621-526·

3191 TACHOMETRIC REGULATION OF A TURBO-REACTOR. J.Friberg.

Automatisme, Vol. 4, No. 2, 45-53 (Feb., 1959). In French.

A servo-control loop for controlling the velocity of a turbo-reactor is described. A tachogenerator is used as the output measuring device. All the components of the loop, including an amplidyne, are crudely approximated by simple lags. The loop is made stable and the loop performance parameters are greatly improved by the addition of a secondary loop around the amplidyne comprising both phase advance and integral control.

T.Horrocks

621-526

3192 STABILITY, OSCILLATIONS, AND NOISE IN THE HUMAN PUPIL SERVOMECHANISM. L.Stark.

Proc. Inst. Radio Engrs, Vol. 47, No. 11, 1925-39 (Nov., 1959).

The pupil reflex to light has been considered as a servo-mechanism, a self-regulated error-actuated control device. This cybernetic approach, requiring the experimenter to make quantitative measurements in animals with a fully intact central nervous system, was made possible using a pupillometer designed for awake, cooperative human subjects. This instrument provided an electronically-controlled light stimulus as well as continuous records of both pupil area and light intensity. Sinusoidal changes in light intensity, small enough for linearization assumptions, were injected in an open-loop fashion to determine the transfer function for pupil system behaviour. The pupil servo is quite stable and has a low gain with an attenuation slope of 18 dB per octave beyond 1.5 c/s. One line of investigation using pharmacological agents has suggested the triple lag to be contributed by the physical law representing the viscosity of the iris neuromuscular system. Another experiment used artificially increased gain to produce instability oscillations whose frequency was predictable from the low gain transfer functions. Still another investigation has shown the pupil system to contain much noise. This noise is not a result of instability, nor generated by the smooth muscle of the iris, nor by other elements of the pupil servoloop, but is injected into the loop from another part of the brain. Further studies in progress are defining nonlinearities in the pupil and retinal system in order to set up an accurate analogue model of the pupil system in the form of a programme for a digital computer.

621-526 : 621.389

3193 MEASUREMENT OF MECHANICAL PROPERTIES OF MUSCLE UNDER SERVO CONTROL. M.Lubin.

Proc. Inst. Radio Engrs, Vol. 47, No. 11, 1880-8 (Nov., 1959).

A hydraulic servo-valve, controlled by analogue units (integrators, adders, inverters), can be used to control the speed of shortening of muscle at rates as high as 1 mm/msec. The apparatus can be used for isometric, isotonic, and controlled release experiments. Both release and stretch, at high or low speeds, can be produced during a single contraction cycle. Force is measured by an unbonded strain gauge of high natural frequency and low compliance. To maintain constant force on the muscle, a signal proportional to measured force is fed into an error detector, whose output controls the servo-valve piston. The instrumentation described can provide the necessary and sufficient information to specify completely both transient and steady-state mechanical properties of muscle.

TELECONTROL . TELEMETERING

621.398

3194 NEW PRINCIPLES OF CONSTRUCTION OF TELEMETERING SYSTEMS WITH PULSE-TIME AND PULSE-WIDTH MODULATION. V.A.Il'in and A.I.Novikov.

Avtomat. i Telemekh., Vol. 19, No. 8, 757-61 (1958). In Russian. English summary: PB 141096T-7, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

Design of single- and multi-channel telemetering systems with exponential transducers is considered. The principles discussed enable multichannel systems, with time channel division and without commutators, to be constructed. The transducers are discussed and an example of a complete system is given.

621.398 : 621.376

3195 NOISE STABILITY IN THE TRANSMISSION OF TELEMETERING SIGNALS ALONG A CHANNEL WITH FLUCTUATION NOISE. V.A.Kashirin and G.A.Shastova.

Avtomat. i Telemekh., Vol. 19, No. 8, 762-7 (1958). In Russian. English summary: PB 141096T-7, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

The potential noise stability of a transmission is determined when using amplitude, frequency, and pulse modulation. Generalized transmission parameters are introduced. It is proved that within a certain range of the signal/noise ratios frequency-modulation provides the highest noise stability.

621.398 : 621.391

3196 OPTIMUM NOISE STABILITY PARAMETERS OF TELEMETERING SYSTEMS. V.A.Kashirin.

Avtomat. i Telemekh., Vol. 20, No. 2, 226-38 (1959). In Russian.

The relations between the mean square error and the system parameters are determined, and presented in graphical form, for telemetering systems using pulse-time and pulse-width modulation. It is shown that for both types of modulation there are optimum transmission parameters which give a minimum mean-square error at a given noise level. Comparisons are then carried out between these two systems and those using pure frequency-modulation or pulse-code modulation with either amplitude, frequency, or phase manipulation.

B.Dentskevich

621.398 : 621.391

3197 NOISE STABILITY OF PULSE WIDTH AND PULSE TIME TELEMETERING WITH LARGE FLUCTUATING ERRORS. N.V.Pozin.

Avtomat. i Telemekh., Vol. 20, No. 2, 239-48 (1959). In Russian.

Formulae for the evaluation of the performance of pulse width and pulse time modulation telemetering systems, in the presence of large noise fluctuations, are derived. The criteria selected are the average and the mean square errors. The analysis considers segmentation of the transmitted pulses as well as the introduction of error pulses in the spaces between the original pulses, due to strong noise in the telemetering channel. The distortions of the pulse-rise time are not considered. The analysis is carried out by sampling of the signal. Comparisons are presented for the performance of several practical telemetering systems.

B.Dentskevich

621.398 : 621.311.4

3198 AN INSTALLATION FOR TELECONTROL OF THE AGROPOLI CONVERTING SUBSTATION. L.Prosperi.

Ingegn. Ferroviaria, Vol. 15, No. 1, 23-32 (Jan., 1960). In Italian.

A 2000 kW, 3.4 kV rectifier substation for railway services is remotely controlled by coded impulses over communication cable. Facilities include control, indication and metering for 60 kV and 3.4 kV switchgear and alarms and controls for the rectifiers. The circuitry is based on that of the Westinghouse Corporation and is described in detail with diagrams.

M.Rathbone

621.398 : 621.311.21

3199 AUTOMATIC CONTROLS OF HYDROELECTRIC STATIONS OF THE BRITISH COLUMBIA ELECTRIC COMPANY LIMITED.

S.R.Hayden, E.P.Ehmayer, H.A.Baumann and R.S.Moulds.

Trans Amer. Inst. Elect. Engrs III, Vol. 78, 1353-62 (1959) = Pwr Apparatus Syst., No. 45 (Dec., 1959).

400 MVA of plant is at present controlled remotely in 6 stations. A typical automatic supervisory control scheme is described in detail.

P.Linton

COMPUTERS . APPLICATIONS

(Refer also to Digital circuits . Switching circuits)

681.142

3200 THE NEW DIGITAL COMPUTER OF THE POLYTECHNICAL UNIVERSITY, BUDAPEST. L.Kozma.
Periodica polytech., Elect. Engng, Vol. 3, No. 4, 321-43 (1959).

Describes Hungary's first digital computer which consists of a stored-programme relay-machine with manual insertion of numerical variables and output to a typewriter. G.H.Stearman

681.142

3201 SPUD, A STORED-PROGRAM UNIVERSAL DEMONSTRATOR FOR COMPUTER TRAINING. M.Raspanti.
Trans Amer. Inst. Elect. Engrs I, Vol. 78, 586-94 (1959) = Commun. and Electronics, No. 45 (Nov., 1959).

A general description of a simple relay computer having many of the features of large electronic computers and which can be used in teaching the principles of such machines. It uses 29 relays and a few hundred diodes and provides 5 bits of erasable memory, manual input and visual output, an automatic clock giving one pulse per second but which can be replaced by a one-shot manual button, and a 32-word storage device for the programme. This latter consists of a punched card which is placed in a frame against contact plungers, and each programme word consists of 9 bits. The instructions available represent elementary operations, and programming techniques similar to those used on large computers can be used to build up more complex operations, e.g. serial addition.
G.A.Montgomerie

681.142 : 621.396.933.4

3202 AN ELECTRONIC COMPUTING SYSTEM FOR AIR TRAFFIC CONTROL. G.H.Scholten.
Proc. Instn Elect. Engrs, Paper 3240 E, publ. March, 1960, 6pp. [Symposium on Data Handling and Display Systems for Air Traffic Control]. To be republished in Vol. 107B (1960).

The present organization of air traffic control is briefly described, and its limitations are mentioned. A survey and some details are given of an electronic computing system, specially developed to meet the requirements of air traffic control.

681.142 : 621.396.933.4

3203 THE APPLICATION OF AN ELECTRONIC COMPUTER TO FLIGHT SAFETY CONTROL, IN PARTICULAR THE IDENTIFICATION OF COLLISION HAZARDS.
W.Haack and W.Hildebrandt.
Telefunken Ztg, Vol. 32, 221-8 (Dec., 1959). In German.

To avoid collisions in the air, it is essential that the flight plans of all aircraft in a given area should be compared to check that no two aircraft are in the same place at the same time and at the same height. The flow diagram of a computer programme for this purpose is explained, using, for the time being, conventional documentation. Future possibilities of automatic display and of linking direct to radar equipment are also discussed. G.A.Montgomerie

681.142

3204 THE SIMPLE CODE FOR ZEBRA.
W.L.van der Poel.
P.T.T. Bedrijf, Vol. 9, No. 2, 31-66 (Aug., 1959).

A very detailed account, with numerous examples, of the design and use of an automatic programming system for the ZEBRA computer. This computer is unusually difficult to programme in machine code on account of its great flexibility and simple construction so that the need for such a system is especially great.
G.H.Stearman

681.142

3205 SOME USES OF COMPUTERS IN SHIPBUILDING.
N.L.Lawrie.
Trans Instn Engrs Shipbld. Scotland, Vol. 103, Pt 4, 100-22 (1959-60).

681.142

3206 ANALOGUE COMPUTERS. PROBLEMS OF DESIGN AND APPLICATION. P.La Cour Christensen.
Ingeniøren B, Vol. 69, No. 5, 181-7 (March 1, 1960). In Danish.

The accuracy of calculation with the computer is considered, including the effect upon accuracy of the operator and amplifier. Choice of time scale, insertion of initial conditions and time delay are discussed. The application dealt with is a position-control servomechanism with Ward Leonard drive and tachometer feedback. A block diagram is first set up and reproduced on the computer with a time scale speeded up by a factor of 100. Details of the calculation are explained. G.N.J.Beck

681.142

3207 PROGRAMMING OF LINEAR DIFFERENTIAL EQUATIONS WITH CONSTANT COEFFICIENTS ON ANALOGUE COMPUTERS. J.Matyáš.
Slaboproudy Obzor, Vol. 21, No. 1, 24-9 (1960). In Czech.

The solution of differential equations by analogue computers can be effected by adopting either series or parallel programming. The former is shown to be preferable to the latter and two of the most common series-type programme schemes are described. Some original programme schemes are also suggested. One of these is particularly suitable when it is necessary to determine a physical system whose impulse response is known. The scheme is also suitable for determining derivatives of the output quantity. A method of setting a programme scheme with autonomous control of the coefficients is described. The duality principle is introduced and properties of dual programme schemes are discussed. Programming of systems of differential equations is mentioned. R.S.Sidorowicz

681.142

3208 MINIMAL SEQUENTIAL MACHINES.
D.B.Netherwood.
I.R.E. Trans Electronic Comput., Vol. EC-8, No. 3, 339-45 (Sept., 1959).

The general class of sequential machines defined by Mealy (Abstr. 729 of 1956) is investigated. It is found that any such machine can be identified with a set of machines of equivalent minimality. A procedure for developing the aggregate of all sets of gates for such minimal machines is evolved, and the problem of selecting components for constructing machines is discussed.

681.142

3209 A TECHNIQUE FOR THE REDUCTION OF A GIVEN MACHINE TO A MINIMAL-STATE MACHINE.
S.Ginsberg.
I.R.E. Trans Electronic Comput., Vol. EC-8, No. 3, 346-55 (Sept., 1959).

A technique is presented for reducing an arbitrary machine S as much as possible to a machine T which can do everything (from the input–output point of view) that S can do. Since the technique is always applicable, it is more powerful (although more cumbersome) than the well-known merging technique. Several examples are given.

681.142

3210 A COMPACT TRANSISTORIZED ANALOGUE COMPUTER MN-10. G.M.Petrov and V.B.Ushakov.
Priborostroenie, 1959, No. 1 (Jan.). In Russian. English translation in: Instrum. Constr., 1959, No. 1, 10-15 (Jan.).

The d.c. operational amplifier comprises a high-frequency and a low-frequency channel, the latter being a square-wave modulated type of fairly conventional form, but with zero-setting and temperature-compensating stages included. The circuit is given without component values. Overall open-loop gain is 5×10^5 and power consumption ~ 0.9 W. Nonlinear units for function generation and multiplication are provided with solid-state diode circuits, which are also discussed. Photographs are shown of the assembled computer, which contains 24 amplifiers and several nonlinear units. Linear voltage range is 30 V. K.C.Garner

681.142

3211 PNEUMATIC ANALOGUE COMPUTER.
N.D.Lanin.
Priborostroenie, 1959, No. 7, (July). In Russian. English translation in : Instrum. Constr., 1959, No. 7, 1-4 (July).

This equipment solves a linear sixth-order differential equation with an overall frequency limitation of 0.5 c/s, and is constructed with Russian standardized pneumatic-control instruments, i.e. a summator and integral term units. Integration time-constants are adjusted by a novel capacity tank arrangement utilizing a flexibly connected tank filled with water, which can be raised or lowered, thus changing the effective storage volume. A prototype unit is described which has an accuracy of about 1.5%. Diagrams and solution curves are given. K.C.Garner

681.142

3212 A NEW SPECTRUM COMPUTER "MERIAC-1-F" FOR THE ANALYSIS OF RECORDED-CURVE DATA.
M.Nishida and T.Furuhata.

J. Inst. Elect. Commun. Engrs Japan, Vol. 42, No. 11, 1045-50 (Nov., 1959). In Japanese.

This comprises two sets of apparatus, an input device and an output device. The former reads automatically at high speed a set of values from the curve of complicated data on a given chart, without missing any physical information, and records the values on 6-unit binary digital tape. The output equipment is essentially an analogue computer for Fourier analysis. It reads automatically the tape from the input equipment at ultrahigh speed, and records the wave amplitude for each component frequency at high speed successively. Block diagrams of the input and output equipments are given and typical output records are shown. A.Wilkinson

681.142 : 621.311.1

3213 AN AUTOMATIC POWER SYSTEM SWING CURVE COMPUTING DEVICE. S.T.Bow and L.S.Chu.
Science Record (China), New Series, Vol. 4, No. 2, 133-8 (Feb., 1960).

A generator unit and a power system are set up in a network analyser and the machine output is converted to a proportional d.c. voltage which is compared with the voltage representing the mechanical input. The resulting signal is integrated twice to yield the electrical phase angle, which controls a servo-driven phase-shifter contained in the generator unit. Damping can be controlled by a feedback loop around the first integrator. By repeating these computing chains, multi-generator systems can be studied. Discussion is aided by some theory and illustrations. Accuracy of performance is considered. K.C.Garner

681.142

3214 THE SIMULATION OF NUCLEAR POWER SYSTEMS. B.Ya.Kogan, Yu.A.Nechaev and F.E.Tranin.
Avtomat.i Telemekh., Vol. 20, No. 3, 349-54 (1959). In Russian.

The possibilities of the application of analogue computers to the solution of nuclear power system problems are considered. The solution of some kinetic and poisoning problems of a reactor is given.

681.142 : 621.311.25

3215 NEW TECHNIQUES IN THE SIMULATION OF NUCLEAR POWER STATIONS. P.Braffort and C.Caillet.
Onde elect., Vol. 38, 583-91 (Aug.-Sept., 1958). In French.

681.142

3216 AUTOMATIC OPTIMIZER. A.A.Fel'dbaum.
Avtomat. i Telemekh., Vol. 19, No. 8, 731-43 (1958). In Russian.
English summary: PB 141096T-7, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

Deals with the problem of constructing a machine for minimizing the function of several variables when additional limitations take place. Some methods of solving the problem are considered and a circuit of the machine is proposed.

681.142

3217 AN ANALOGUE COMPUTER FOR CONSTRUCTING CONFORMAL MAPPING FOR N-ORDER POLYNOMIALS. V.A.Brik and S.A.Ginzburg.
Avtomat. i Telemekh., Vol. 19, No. 7, 674-83 (1958). In Russian.
English summary: PB 141096T-7, obtainable from Office of Technical Services, U.S.Dept. of Commerce, Washington, D.C., U.S.A.

An analogue computer is described which makes it possible to analyse n-order polynomials (n = 1, ..., 10) with real and imaginary coefficients. The main purpose of the computer is to determine characteristic equation roots and to plot Michaelov loci.

681.142

3218 A METHOD OF SOLVING A CERTAIN CLASS OF INTEGRAL EQUATIONS BY MEANS OF COMPUTERS. Yu.S.Val'denberg.
Avtomat. i Telemekh., Vol. 19, No. 8, 731-43 (1958). In Russian.
English summary: PB 141096T-7, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

Zeidel's iterative method of the approximate solution of Fredholm and Volterra 1st- and 2nd-type linear integral equations is used. The use of computers to solve special types of these equations is indicated. The results of practical application of this method to automatic control system synthesis problems are considered.

681.142

3219 LINEAR TRANSFORMATIONS OF BINARY CODES. N.Ya.Matyukhin.
Avtomat. i. Telemekh., Vol. 19, No. 8, 776-87 (1958). In Russian.
English summary: PB 141096T-7, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

Linear transformations of binary codes with a fixed number of elements per code symbol, when for each possible symbol there is a reciprocally single valued relation, are considered.

681.142

3220 DIGITAL INTEGRATOR SET-UP FOR PROGRAMMING 2nd ORDER CURVES. A.A.Voronov and G.N.Sokolov.
Avtomat. i Telemekh., Vol. 20, No. 2, 176-83 (1959). In Russian.

681.142

3221 CALIBRATION OF PADDED-POTENTIOMETER FUNCTION GENERATORS. G.A.Korn.
Instrum. Control Syst., Vol. 32, No. 10, 1539-40 (Oct., 1959).

The circuit described holds the (n + 1)th tap at a desired voltage while the tapping resistor concerned with the nth tap is adjusted to give a null on a detecting instrument, with reference voltage applied across the potentiometer. Circuit and operating details are given. K.C.Garner

681.142

3222 A METHOD OF DESIGN OF NON-LINEAR FUNCTION GENERATORS USING DIODES. S.A.Doganovski and L.N.Fitsner.
Priborostroenie, 1959, No. 1 (Jan.). In Russian. English translation in: Instrum. Constr., 1959, No. 1, 16-19 (Jan.).

Description of diode linear segment approximation networks is given with a general analysis of such circuits. Some useful circuits are illustrated, and one numerical example is worked out. K.C.Garner

681.142 : 518

3223 REPETITIVE ANALOG COMPUTER FOR ANALYSIS OF SUMS OF DISTRIBUTION FUNCTIONS. F.W.Noble, J.E.Hayes, Jr and M.Eden.
Proc. Inst. Radio Engrs, Vol. 47, No. 11, 1952-8 (Nov., 1959).

Many experimental procedures yield curves which are sums of distribution functions. Examples of such curves include electrophoretic, diffusion, and ultracentrifugal patterns, absorption spectra, and curves from countercurrent distribution and from partition chromatography in either liquid or vapour phase. In a given type of curve, each of the component functions is identical to the others in form (for example Gaussian) but can have very different values of the parameters governing height, width, and position along the abscissa. The parameters for each component are to be determined by an analysis of the sum curve. The computer to be described performs this analysis by synthesizing a number of distribution functions of the desired form, each with adjustable parameters, and presenting, on an oscilloscope, the sum of these functions for comparison with the experimental curve being analysed. A match is made visually by adjustment of the various parameters. When a match has been obtained, the parameters of the component functions are read out, following a switching procedure which presents the individual functions in sequence.

681.142 : 621-526

3224 SIMULATION OF NON-LINEAR EFFECT BY ANALOGUE COMPUTER. H.B.Mohanti.
J. Instn Telecomm. Engrs (New Delhi), Vol. 5, No. 3, 163-8 (June, 1959).

Describes the usual circuits using operational d.c. amplifiers for dead-space, hysteresis or back-lash, limiting, static and Coulomb friction effects. Although not a nonlinearity, transport lag is also included. Concludes with a simple discussion on the simulation of a nonlinear servomechanism. K.C.Garner

681.142

3225 THE RESISTANCE NETWORK, A SIMPLE AND ACCURATE AID TO THE SOLUTION OF POTENTIAL PROBLEMS. J.C.Francken.
Philips tech. Rev., Vol. 21, No. 1, 10-23 (1959-60).

681.142

3226 ELECTROMECHANICAL DIFFERENTIAL ANALYSER, DIANA. J.Tomášek.
Slaboproudy Obzor, Vol. 21, No. 1, 15-23 (1960). In Czech.

The machine is based on known principles. All the variable quantities, including the independent variable, are represented by the angular displacement of a suitable shaft, the displacement being proportional to the magnitude of the quantity. All the mathematical

operations are performed by mechanical means. The analyser consists of an independent-variable generator, a set of integrating units, a set of adding units, a number of recording units and an auxiliary equipment (controls, supplies etc.). While the individual units give an error of 0.2%, the overall error of the system is usually 1%. The analyser is particularly suitable for solving the problems of the theory of automatic control. The following problems can be solved: (1) linear differential equations; (2) differential equations with variable coefficients; (3) nonlinear differential equations; (4) delay-system equations and (5) Fourier analysis and correlation functions. A general description of the analyser is given and its application is discussed in some detail.

R.S.Sidorowicz

681.142

3227 ANALOG DIFFERENCE ANALYSER BY THE USE OF DELAY LINE. Y.Kitahama.

J. Inst. Elect. Commun. Engrs Japan, Vol. 42, No. 11, 1081-8 (Nov., 1959). In Japanese.

The general principles are discussed of computers for the solution of difference equations, based on analogue computation by means of delay lines. The analysis is applied to the solution of the first-order difference equation and then the frequency response and the errors of such an analyser are calculated. The results show that this analyser has sufficient accuracy for practical use. The construction of experimental equipment is described and results obtained with it are shown graphically. A.Wilkinson

681.142 : 541.12

3228 AN ANALOG COMPUTER TO SIMULATE SYSTEMS OF COUPLED BIMOLECULAR REACTIONS.

E.F.Macnichol, Jr.

Proc. Inst. Radio Engrs, Vol. 47, No. 11, 1816-20 (Nov., 1959).

An analogue computer has been constructed to simulate, as nearly as possible, the flux of material in systems of coupled chemical reactions. Concentrations of various reactants, intermediates, and products are represented by the potentials at the outputs of electronic integrators. Rates of turnover of materials are represented by charges flowing to and from the integrators. The charges are caused to circulate by means of a "pump" mechanism that transfers charge at a rate proportional to the triple product of three voltages, two of which are derived from integrators and represent the concentrations of reactants. The third represents a rate constant. One voltage controls the frequency of an oscillator, the second, the duration of a triangular waveform, which is triggered by the oscillator, and the third, its rate of rise. By suitable interconnection of a number of integrators and pumps, a wide variety of reaction schemes can be simulated.

681.142

3229 ELECTRONIC CONTROL OF SOME ACTIVE BIOELECTRIC MEMBRANES. J.W.Moore.

Proc. Inst. Radio Engrs, Vol. 47, No. 11, 1869-80 (Nov., 1959).

Special purpose real-time analogue computers are used to measure and control nerve membrane potential or current in a squid axon or a single frog node. Under current control, the membrane potential has a region of discontinuity and an "action potential" rather similar to that observed in normal impulse propagation. With potential control, the current pattern is a continuous function of the potential, and a negative resistance is found in the region of potential discontinuity for the current-controlled membrane. The membrane's electrical characteristics may therefore be compared with some two-terminal transistor switching circuits.

681.142

3230 THE USE OF AN ANALOG COMPUTER FOR ANALYSIS OF CONTROL MECHANISMS IN THE CIRCULATION. H.R.Warner.

Proc. Inst. Radio Engrs, Vol. 47, No. 11, 1913-16 (Nov., 1959).

Two approaches are presented to the study of regulation in the circulatory system. One consists of programming on an analogue computer equations to represent part of the system and then, using a suitable transducer, substituting the computer for the biological component. An example is presented in which a part of the mechanism which regulates arterial pressure (the carotid sinus) is simulated. The other approach involves simultaneous solution of equations derived to represent each system component. Simulation of a transient disturbance in blood distribution (Valsalva manoeuvre) is presented to illustrate the use of this approach in predicting the role of each component in determining over-all system behaviour.

681.142

3231 ANALYSIS OF THE COMPENSATION OF THE STRIP THICKNESS VARIATIONS IN A ROLLING MILL BY AN ELECTRONIC ANALOG COMPUTER.

S.A.Doganovskii and A.A.Fel'dbaum.

Avtomat. i Telemekh., Vol. 20, No. 2, 192-205 (1959). In Russian.

681.142 : 621.397.933.4

SURVEY OF DATA HANDLING FOR AIR TRAFFIC CONTROL. See Abstr. 3139

681.142 : 621.396.963

FIXED-COIL DISPLAY SYSTEM FOR DATA EXTRACTION. See Abstr. 3141

681.142 : 621.396.933.4

AN EXPERIMENTAL SYSTEM FOR AUTOMATIC RADAR TARGET DETECTION AND DIGITAL CODED PLOT EXTRACTION AND TRANSMISSION. See Abstr. 3140

681.142 : 621.396.965.8

METHODS OF EXTRACTING RADAR DATA FOR AUTOMATIC PROCESSING. See Abstr. 3142

681.142 : 621.396.933.1

CATHODE-RAY-LABELLED PLAN DISPLAY. See Abstr. 3135

681.142 : 621.318.42

SIMULATION OF INDUCTANCE BY AN INTEGRATING CIRCUIT. See Abstr. 2857

681.142 : 621.395.625.3

ON THE OPTIMUM DESIGN OF MAGNETIC DRUM STORE. See Abstr. 3084

MECHANICAL AND CIVIL ENGINEERING TECHNOLOGY

MATERIALS . TESTING

620.16 : 621.316.925

3232 FUNCTIONAL CYCLING TO ASSUME RELIABILITY OF AIRCRAFT CONTROL EQUIPMENT.

R.E.Hulsey and L.L.Kessler.

Trans Amer. Inst. Elect. Engrs II, Vol. 78, 356-60 (1959) = Applic. and Industr., No. 45 (Nov., 1959).

Describes the functional cycling tests carried out on semiconductor components and complete panels for the control and protection of two or more aircraft a.c. generators operated in parallel. It is claimed that by functional cycling of all semiconductor components and each complete panel, the mean-time failures has been increased from 80 to 4000 hours. The criteria for functional cycling equipment are stated and the automatic equipments used for the tests are described and illustrated with photographs and block diagrams; the testing procedure is controlled by punched cards. Summaries of the results of tests on these particular control panels are given for different cycling periods. J.T.Hayden

620.179.1

3233 PROGRESS IN TECHNOLOGY AND EQUIPMENT FOR EDDY CURRENT INSPECTION.

H.L.Garbarino and H.N.Newin.

Nondestr. Test., Vol. 17, No. 4, 229-34 (July-Aug., 1959).

Two main types of equipment are in common use. In one, the metal part under test is fed through the test coil, a technique particularly suitable for mechanization, while, in the other, a probe coil is held close to the piece being inspected. The second method is

capable of high resolution and is suitable for locating small defects. The theory relating to the penetration of eddy currents and magnetic fields into a material is theoretically treated. They behave as transverse travelling waves having a direction of propagation perpendicular to the field and current directions. The design of suitable testing equipment is discussed, particular attention being paid to test frequency. At too low a test frequency, it would be possible for a defect to pass through the coil at a time when the eddy current is small in magnitude. Frequency is important because the depth of penetration is inversely proportional to its square root, but frequency also affects the magnitude and phase of the signal fed to the test coil and hence the impedance, the parameter on which the sensitivity of the instrument depends. A.C.Whiffin

620.179.14

3234 INVESTIGATION OF AN ELECTRICAL NON-DESTRUCTIVE METHOD OF MEASURING THE DEPTH OF SURFACE HARDNESS IN FLAME-HARDENED STEELS. J.A.Betts and J.P.Newsome.
Proc. Instn Elect. Engrs, Monogr. 372 M, publ. April, 1960. 7 pp. To be republished in Part C.

At the present time there exist no established, non-destructive methods for the measurement of depth of hardness in surface-hardened steels which are independent of the effects of chemical composition and quench procedure. Electrical non-destructive methods are dependent upon changes in the electrical and magnetic properties of steel which occur when it is hardened. The electrical method investigated was an a.c. one, based upon the measurement of the complex impedance of a search coil magnetically coupled to the test surface. Distinctly favourable results were obtained, and the theoretical and practical aspects of the procedure are considered.

620.197.5

3235 DEEP GROUND BEDS FOR CATHODIC PROTECTION. S.E.Trouard and E.A.Wagner,Jr.
Trans Amer. Inst. Elect. Engrs II, Vol. 78, 278-85 (1959) = Applic. and Industr., No. 45 (Nov., 1959).

The conventional shallow network of buried electrodes for cathodic protection is liable to be complicated when foreign structures are within the protected zone and may involve unwanted drain of current. A theoretical and practical account is presented of an electrode system comprising vertical electrodes carried to a depth of up to 300 ft. which has minimized these effects and has clear applications in congested areas as a result of the lower earth resistance which results, and the smaller space requirements. M.Rathbone

WELDING . SOLDERING

621.791.75

3236 THE ELECTRIC ARC IN WELDING. INTRODUCTORY SURVEY. E.C.Rollason.
Brit. Weld. J., Vol. 7, No. 2, 71-2 (Feb., 1960).

621.791.75

3237 ARC CHARACTERISTICS AND THEIR SIGNIFICANCE IN WELDING. D.R.Milner, G.R.Salter and J.B.Wilkinson.
Brit. Weld. J., Vol. 7, No. 2, 73-88 (Feb., 1960).

A survey is made of those aspects of arc physics which relate to chemico-metallurgical reactions occurring between the arc atmosphere and the weld metal, heat transfer from the arc, and metal transfer in consumable electrode welding.

621.791.75

3238 GAS ABSORPTION FROM ARC ATMOSPHERES. G.R.Salter and D.R.Milner.
Brit. Weld. J., Vol. 7, No. 2, 89-100 (Feb., 1960).

The reaction between the high-temperature gases in the arc atmosphere and molten metal was investigated for the simplest system that could be envisaged, i.e., the absorption of oxygen from an argon–oxygen atmosphere by titanium, that amount of oxygen absorbed being determined by hardness surveys. The effect of welding variables was investigated and it was found that the rate of reaction increases with current, arc length, and oxygen partial pressure, and that it is also partly dependent on the condition of the tungsten cathode and the velocity and flow pattern of the gas around the arc. It is concluded that the process controlling the reaction is the rate of diffusion of oxygen across a stagnant gaseous boundary layer adjacent to the metal surface, and that this takes place over an "active area" in the high-temperature region of the arc. It is postulated that the thickness of the boundary layer is determined by a plasma jet which arises from the constriction of the current at the cathode spot. The magnitude of the high-temperature "active area" is determined by the current and arc length. An attempt was made to formulate the quantitative development of this model by considering mass transfer from a hot jet impinging on a plate, in which conventional mass transfer concepts were applied.

621.791.75

3239 METAL TRANSFER IN INERT-GAS SHIELDED-ARC WELDING. J.C.Needham, C.J.Cooksey and D.R.Milner.
Brit. Weld. J., Vol. 7, No. 2, 101-14 (Feb., 1960).

It is postulated that high-velocity plasma jets in the arc are responsible for metal transfer in high current density welding arcs. The proposed mechanism is that the plasma jet exerts a force on the globule as it forms on the end of the electrode wire, and when this force exceeds the restraining force of surface tension the globule begins to pull away from the electrode, the acceleration increasing as the area of the restraining neck decreases and thus exposing more of the globule to the jet. After the globule becomes detached from the electrode it accelerates freely under the action of the jet to a terminal velocity which is determined by the force on the globule and the distance over which this force acts. Experimental evidence for this hypothesis was obtained from a high-speed cine-photography examination (9000 frames/sec) of aluminium transfer, which showed that there is a force acting on the globule after it becomes detached from the electrode and that the vapour emanating from the globule streams in the direction of travel. Other subsidiary experiments were carried out to demonstrate the presence of plasma jets in welding arcs. A theoretical approach to the problem was made by the application of the principles of fluid flow, and the free flight velocities and accelerations predicted show satisfactory agreement with experimental determinations. The conditions of removal of the drop are more difficult to formulate theoretically, but it is shown that the plasma jet mechanism can account for the existence of the transition current and the marked change in drop diameter which is associated with it.

621.791.75

3240 HEAT TRANSFER FROM ARCS. J.B.Wilkinson and D.R.Milner.
Brit. Weld. J., Vol. 7, No. 2, 115-28 (Feb., 1960).

The energy distribution for arcs between a non-consumable tungsten cathode and a water-cooled copper anode were determined in atmospheres of A, N, He and H. In general, 80-90% of the energy expended in an arc of this type was found to go to the anode, with the remainder divided between cathode heating and heat carried away by the gas, which leaves the arc region at temperatures of the order of 1000-6000°K. The main part of the investigation was directed to the examination of the heat flow to the anode, which comprises electron heating, together with heat transfer from a plasma jet which originates from constriction of the current caused by the cathode spot. The velocity and diameter of the jet in argon arcs were determined at the anode by comparing the pressure increase it creates with that caused by jets of known velocity and extent. It was found that the jet velocity is of the order of 10^4 cm/sec, and the diameter a few millimetres. The intensity of the jet in dissociable gases made measurements impossible because of the rapid erosion of the apparatus. For argon arcs the heat transfer from these high-velocity, high-temperature jets was separated from heating caused by the electron stream in experiments with a three-part anode, in which a centre section received the electron heating together with some plasma jet heating, while a surrounding annulus was heated only by the plasma jet. Conventional heat transfer concepts were applied with some success to the interpretation of the data on heat transfer from the jet to the cooled anode. It is suggested that jets of this type in dissociable gases are responsible for deep-penetration effects in welding.

LIST OF JOURNALS

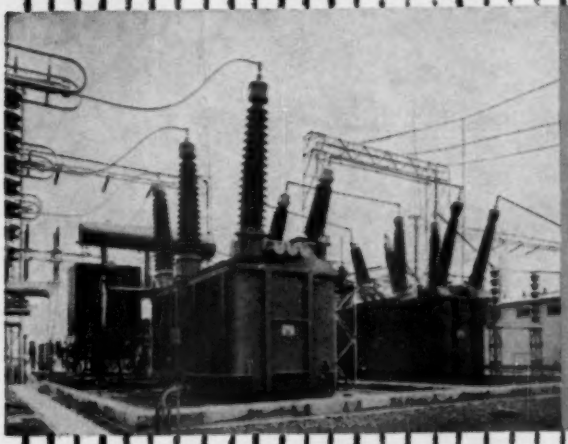
The following list supplements the List of Journals published with the Index to Volume 62 (1959). Reprints of the List of Journals can be obtained from The Institution of Electrical Engineers, Savoy Place, London, W.C.2, price 2s.0d. post free.
The addresses given are believed to be correct at the date of publication, but no responsibility can be accepted for errors.

Elect. Supervisor	Electrical Supervisor Association of Supervising Electrical Engineers, 23 Bloomsbury Square, W.C.1.
Elektrofertigung	Elektrofertigung A supplement to Elektrie, published as part of that journal, but with separate pagination.
J. appl. Phys. Japan	Journal of Applied Physics, Japan Society of Applied Physics, Department of Applied Physics, Faculty of Engineering, University of Tokyo, 1 Motofujicho, Bunkyo-ku, Tokyo.
J. Coll. Arts Sci. Chiba Univ. nat. Sci. Ser.	Journal of the College of Arts and Sciences, Chiba University, Natural Science Series. Chiba, Japan.

ERRATA

Abstr. 1356 (1960) line 9: for "is" read "in".

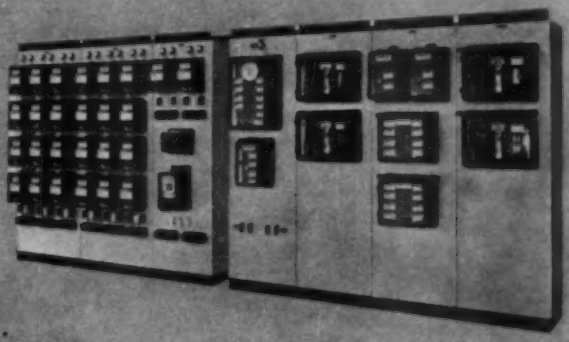
AUTHOR INDEX

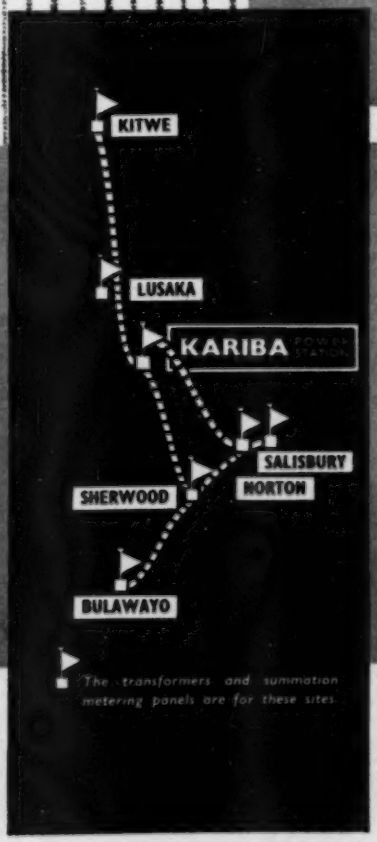


One of the two Ferranti 120,000 kVA 330/234 kV auto transformer and series booster installations at the Kitwe sub-station.

FERRANTI at KARIBA

Ferranti Summation Metering Panels for the Kariba Power Station.





The transformers and summation metering panels are for these sites.

TRANSFORMERS

All the sub-station transformers for the Kariba Hydro-Electric Scheme are being supplied by Ferranti Ltd. They comprise two 120,000 kVA, 330/234 kV 3-phase auto transformers with series boosters, eight 60,000 kVA, 330/88kV and four 60,000 kVA, 330/33 kV 3-phase double wound transformers. The transformer installations at Norton, Lusaka and Kitwe are complete. Work at Salisbury, Bulawayo and Sherwood is well advanced.

SUMMATION METERING

For the same scheme Ferranti Ltd. are supplying Summation Metering Equipment comprising: Precision grade integrating meters, Electro-mechanical summators, Printometer Demand Recorders and Suites of metering cubicles. These equipments will be used to meter six 100 MW generator sets at Kariba Power Station and also the supplies to the Transforming Stations at Kitwe, Norton, Salisbury, Lusaka, Sherwood and Bulawayo.

The consulting electrical and mechanical engineers are Messrs. Merz & McLellan.

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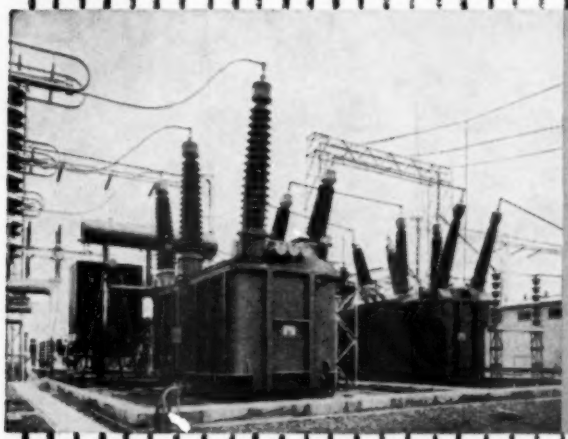

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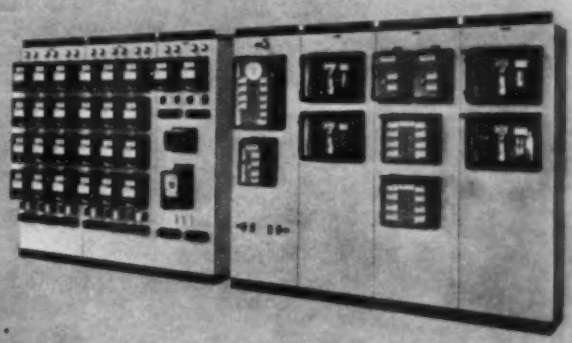

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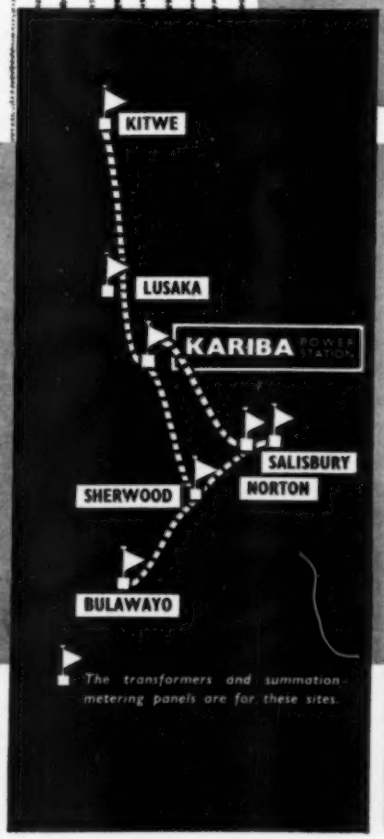

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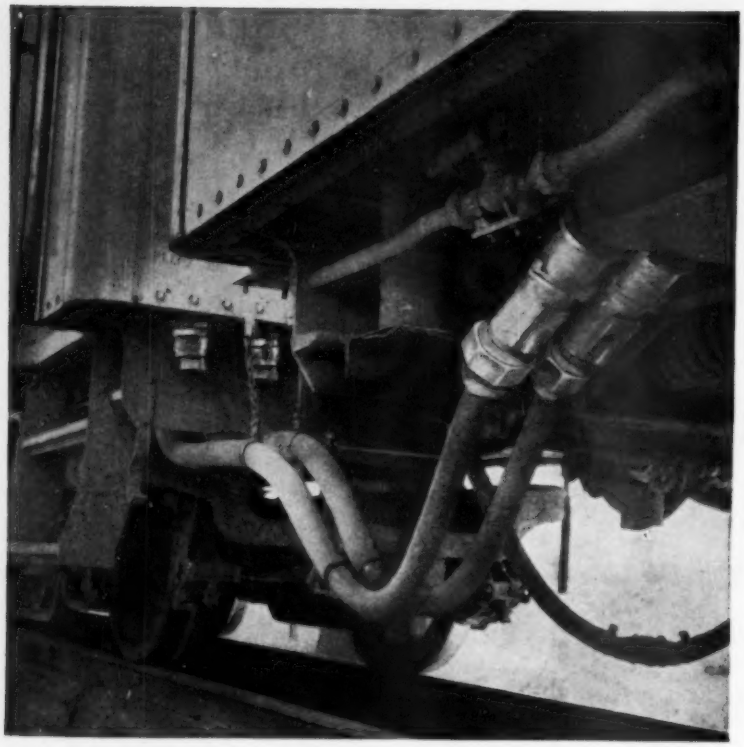

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